

The Scientific Review, AND SCIENTIFIC AND LITERARY REVIEW,

A RECORD OF PROGRESS IN ARTS, INDUSTRY, AND MANUFACTURES,

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*** The above List is prepared from the Patent Records by Mr. T. Morgan, Secretary of the Inventors' Patentright Association, Limited.

CRANIOLOGY and CRIME.—The British Medical Journal presents, at some length, the results arrived at by Professor Benedict, in his examination of the brains of sixteen criminals. These, on comparison with the healthy brain, proved to be abnormal. Not only, too, has he found that these brains deviate from the normal type, and approach that of lower animals, but he has been able to classify them in three categories. First, absence of symmetry in the two halves of the brain; second, an obliquity of the interior part of the brain or skull; third, a distinct lessening of the posterior cerebral lobes.

Correspondence.

Sir,—As I pass along Farringdon Road, from the Farringdon Street Station, at 9 in the morning, to business, on clear mornings the appearance of the sun rising behind the upper dome of St. Paul's Cathedral is a common matter of admiration; and yesterday morning I was astonished to see it was actually more backward in its course than on the day next the shortest day (21st December)—that is, it was quite below the top of the large dome, and more to the east, and altogether more backward and nearer the horizon than then. Have you any corroboration of this in your observations, or from others? Can it be possible that the shortest and longest days are not accurately timed? We certainly do not notice much alteration for two or three weeks after the usual dates.—Yours truly,

AN OBSERVER.

Islington, N., Jan. 4, 1878.

IMPROMPTU.

The garden glows, now even gleams
With lights we love; the mystic beams
Which dawn upon the soul, when fall
The rays which hold our hearts in thrall,
Bring the soft vision of a moon
Which shone upon our path last June!

Around us trembled, through the leaves,
Sweet-scented, lily-laden air.
Ah! through my heart the pale moonlight
Strikes like a silver sword to-night;
For it falls blankly, where you were,
Beneath the arbour's jessamine eaves.

V. GONVILLE, D.

A REVERIE TO IANTHE.

My lady wakes my soul with song,
And lives with me the whole day long
In dreams of love:
In early dawn, while linnets sing,
And soars the lark on lightest wing,
And coos the dove!

At noon, beneath the willow's shade,
By wood, and fern, and grassy glade
I hear her voice:
E'en as the murmur of the stream,
Which, watching, still the more I dream,
And thus rejoice!

And, when the rosy shadows leave
The horizon's arch, at waning eve,
And down the dale
I listen to the cuckoo's call,
And sweeter still—more dear than all—
The nightingale:

I linger long, until the light
Of beaming stars unveil the night,
And softly shine:
When to her home my fancy strays,
Till mingling 'mid my vision plays
Her face divine!

HENRY GEORGE HELLON.

INVENTORS' EXHIBITION.—An Exhibition of a somewhat novel kind has been opened in the Palais de l'Industrie, Paris, the contributions being strictly confined to new inventions. It is proposed to hold the exhibition annually, and the opinion prevails that it will turn out a great success—not in a popular sense, but commercially. There is certainly a good idea in bringing together all new inventions, or, at least, as many as possible. To many persons such a collection will be infinitely more satisfactory than a book on the subject, although an illustrated catalogue would furnish a valuable record of the practical science of the year.—*British and Foreign Journal of Commerce.*

A NEW TRADE MARK TREATY.—“The British and Foreign Journal of Commerce, Trade Marks, and International Exhibitions,” announces that a Treaty for the protection of trade marks was concluded, on the 26th October, between Spain and the United States.

Reviews.

ANTHROPOLOGY.

"Anthropology." By Dr. Paul Topinard, Preparator of Anthology at the Ecole des Hautes Etudes, Curator of the Museum of the Anthropological Society of Paris, &c.; with Preface by Professor Paul Broca. Translated by Robert T. H. Bartley, M.D., with forty-nine wood-cuts. London: Chapman & Hall, 193, Piccadilly, 1878.

THIS is one of the volumes of the Library of Contemporary Science now in course of publication by Messrs. Chapman & Hall, with the object, as we understand it, not so much to popularise science in the sense in which that term is usually used, but to more widely disseminate amongst educated men the results of the researches of savants of acknowledged reputation in a more readable and less costly form than has been hitherto effected. As regards the particular work now before us, the author's preface gives the following exposé of its origin and character:—

"Anthropology, of all branches of natural science, was the last to be developed; nevertheless it is one which now lays claim to hold the first place in the attention of the scientific world. For fifteen years this science, whose title even was not settled, had but few adherents. Since 1749, the date at which it was inaugurated by Buffon, there have been in every generation, a certain number of learned men who have directed their attention to it, and among these have figured many distinguished anatomists and naturalists. But these men, devoted to studies whose utility was not as yet appreciated, formed, as it were, a staff without an army, and if they had a few select readers we may safely say they had not the public at large.

"A new era manifested itself in 1859, in consequence of the foundation of the Société d'Anthropologie de Paris. The Ethnological Societies of Paris, and of London and New York, which had preceded it, had not been able to extend their influence beyond a very limited area; some valuable works had been published, but the majority of the members remained indifferent. When, in 1848, the Société Ethnologique de Paris ceased to hold its meetings, no notice was taken of it; and when, eleven years later, some of its members resolved to found a society for the special study of Man, and of the races of mankind, it was with difficulty, after six months of parleying, that nineteen of the promoters could be brought together, of whom many were only members in name.

"This new society, founded with so much difficulty, obtained, however, rapid and unexpected success. Enlarging all at once the programme of ethnology, by grouping around the study of the human races the medical sciences, comparative anatomy, and zoology, prehistoric archaeology, palæontology, linguistics, and history, and designating under the title Anthropology the science whose domain was thus largely extended, the new society opened its portals to all those who cultivated these numerous branches of human knowledge.

"Ethnology had remained, up to this period, a speciality prosecuted by but few; anthropology, on the contrary, addressed itself to learned men of every class. It attracted to it physicians, naturalists, archaeologists, linguistics, happy to be able, each in his sphere, to lend his aid; and soon these valuable auxiliaries manifested their desire to become proficient by an assiduous devotion to its study. To the rapid accession of learned men to its ranks, and of others who became interested in it, are we to attribute the rapid diffusion of anthropological knowledge.

"This movement, which had its origin in France, rapidly extended to other countries. On all sides anthropological societies sprang up, which were founded on the same basis and worked on the same plan. Anthropological conferences were organised, and in the greater number of general meetings for the advancement of science, anthropology has now its section the same as other sciences. These conferences have been remarkable from the number of members who have taken an active part in them, and from the still larger number of their adherents. The latter are no longer to be computed by hundreds, but by thousands. For example, the only society of anthropology in Paris has now on its roll upwards of four hundred native members, while the members comprising the two English societies is nearly double that number. There is now a large and distinguished body of persons who fully estimate the importance of the science, who approve its objects, and who naturally interest themselves in them. This is the happy outgrowth of the extension of the general scheme of anthropology. Other results, still more fortunate, have been brought about. Works have become multiplied in proportion to the number of workers. Many questions of altogether a novel character have arisen; many others have changed their aspects; all have been elucidated by constant and patient research. Innumerable facts have been observed, discussed, verified; and in the brief period of sixteen years greater progress and more important discoveries have been made in anthropology than at any period since its foundation.

"But the rapidity with which the development of anthropology is proceeding is a source of considerable difficulty to those who are desirous of studying the science. No one can pretend to become conversant with all the subjects of general knowledge which it lays under contribution; to master them with the depth and precision which imply a thorough acquaintance with them he must abandon the idea of becoming a perfect anthropologist. Division of labour is more necessary here than anywhere else. In this vast domain each one pitches his tent in the spot where his special tastes, his peculiar bias, and his particular knowledge invite him. But in order that these researches, so multiform, may not run the risk of becoming discursive, and may be directed to one and the same end, it is necessary that all labourers in the work should early become acquainted with the general principles of anthropology, with its tenets, and with the whole of the facts which it has established. This want has been sensibly felt for some years. From all sides a demand has sprung up for an elementary treatise on anthropology—a systematic résumé where questions might be studied which are the subject of discussion in our societies or treated of in original papers; a work, in short, which should be at the same time a guide for students and a manual of reference for others. Such a work has not appeared up to the present time. The remarkable "Leçons sur l'Homme," by Carl Vogt, embraced only the subject in a general way; they were published, moreover, twelve years since, and do not give the latest information on the science. The excellent little treatise of Omalius d'Halloy, "Sur les Races Humaines," is purely ethnological; it embraces only one special part of anthropology, and does not supply the want to which we refer.

"An important gap has to be filled up. The founders of the Bibliothèque des Sciences Contemporaines have felt it incumbent upon them to step in, and have confided to Dr. Topinard the difficult task of elucidating, in a single volume, a science of vast dimensions in progress of rapid development, and one which hitherto has not received sufficient attention. More than one had shrunk from attempting it. An indi-

vidual devoting himself to original research, and engaged in duties to which he is anxious to give his undivided attention, is generally little disposed to employ his time in writing a work of a popular character. But M. Topinard is one who is thoroughly equal to the task. An appeal was made to his ardent love for anthropology, which appeal has not been made in vain. He has been most unwearied in his efforts, and has brought his work to a successful issue. He has rendered signal service to anthropology, for which, on behalf of the friends of the science, I cordially thank him."

Dr. Bartley, in a Preface as Translator, states that he does not endorse all the views of Dr. Topinard, and professes himself a believer in the authenticity of the Mosaic Records.

This work is so full of interesting matter that there is no page of it that might not be quoted as a sample. However, haphazard we present our readers with the following statements as to "Albinism Monstrosities, Mental Alienation, and Idiocy:"—

"Albinos are individuals in whom the pigmentary matter is so far deficient that the skin and hair are colourless, the iris is transparent, and the choroid coat destitute of the dark pigment for the absorption of redundant rays of light. In consequence of this they are unable to bear bright sunlight, and see better at night than during the day. Their eyeballs are affected with a perpetual oscillating movement, their skin and hair are colourless, or of a dull white, the eyes reddish, the transparency of the tissues showing the blood circulating through the capillaries. They are often indolent, and without muscular vigour. There are partial albinos, in whom all the above symptoms are observed, but in a less degree. They may easily pass unnoticed among the white races, but are very observable among the black; their hair is flaxen or red, their skin coffee-coloured or speckled, their eyes are light blue or reddish.

"Both are met with among all races and under all climates. In some of the native courts on the west coast of Africa, especially in Congo, they are an object of veneration, and go by the name of "dondos." Dr. Schweinfurth has seen a great number of them with the King of the Monbouts on the banks of the Bahr-el-Ghazel. From their presence among the blackest populations, Pritchard framed an important argument in favour of the influence of external circumstances, and of the derivation of the human race from one primitive pair. He delighted to reiterate it, and moreover he was the first to establish the fact that their hair was as woolly and their features were as negro as those of their fellow-countrymen of the same tribe. We say again, albinism is only a monstrosity, a pathological condition which has been cured, and we must take care how we place explicit reliance on the confused accounts given of it by travellers. A cutaneous affection called pityriasis versicolor is seen in whites, as a partial loss of colour of some portions of the skin, while the accumulation of pigment upon other portions causes them to appear of a deeper colour. The eyes are not at all affected in these cases.

"Our opinion is that what has been called in negroes piebald, and described as an example of partial albinism, is the same thing. The scaly affection called ichthyosis, often of a marked hereditary character, to which Mr. Darwin frequently alludes, and the subjects of which deserve the title of porcupine men, has no interest for the anthropologist.

"Two individuals, Russians by birth, were recently exhibited in Paris, called dog-men, whose bodies were covered with a quantity of long coarse hair; they were also said to have exhibited a defective development of the teeth. Similar cases in Burmah and India have been described, which were hereditary through three generations.

"Monstrosities, of which there are many varieties, are produced during embryonic or foetal life, either in consequence of hereditary predisposition, of some accident to the mother, or from some disease of the foetus. They arise either from arrest, excess, or perversion of development. Some are incompatible with life, others do not interfere with it. We are not about to give an explanation respecting the two theories—either the one as to the pre-existence of germs, as maintained by Winslow, but now abandoned, and which means that the embryo represents from the very first the future being in its entirety; or the other, that of Serres and Isidore Geoffroy Saint-Hilaire, called epigenesis, which we have described at page 128, and which admits progressive development. Among these monstrosities we may mention polydactylism, or the existence of from four to seven fingers, which has been noticed as having occurred through many generations; inversion of the viscera, in which the heart is found only on the right side, or where all the viscera are inverted; the absence of one or more limbs; hermaphroditism; hypospadias; imperforate anus; hare-lip; spina bifida; microcephalus, &c. One of the most curious of the teratological groups is diplogenes, in which the whole body is more or less double, as if there had been a fusion of two germs, or a duplication of a single one. The Siamese twins, and the two Zambo girls exhibited in 1874 in Paris were of this kind. Perhaps we ought to speak of them as examples of supplementary limbs, as that of a girl of fourteen or fifteen years of age, exhibited the same year before the Anthropological Society by Dr. Ball.

"Monstrosities are not peculiar to Man; they are frequent also among animals. We shall only speak of those which are specially interesting to us as taking place in the head, as microcephalus and hydrocephalus. Under the name of mental alienation we include all the various functional disorders of the brain. These may be reduced to three: (1) Mania properly so called, which breaks out in individuals hitherto sane, has two forms—the one of excitement, the other of depression—and is general or partial; (2) Dementia, which is a general and progressive feebleness of all the faculties, and is of two kinds—accidental or senile; (3) Idiocy, in which the faculties have never attained their full amount of development. In the three forms, the volume of the brain is increased or diminished according to the amount of disease, and according to the greater or less amount of blood which it contains. In ordinary mania there is rather an increase, and in dementia, sooner or later, a decrease. The lesion affects the entire organ, its central portions, its convolutions, and sometimes solely the gray substance covering them, and the functional disorder becomes permanent. It is impossible to be deceived, and true human superiority consists in knowing how to look the truth in the face. The most beautiful of our intellectual manifestations—those of which we are so justly proud—are the product of a material organ, in the same way as bile is the product of the liver, and the circulation is the product of the contractions of the heart. A sound and healthy brain produces sound judgment and understanding; a diseased, bloodless, and impaired brain produces the reverse. That which distinguishes Man from the brute is the quality and quantity of the organ—the quality and quantity of the product.

"If mania and dementia only concern medicine, idiocy has an interest for anthropology; it exhibits the brain sometimes less developed, more simple, more or less stunted in growth, and approaching more to that of animals.

"There are many direct causes of idiocy. Sometimes the volume of the brain is nor-

mal, but its convolutions are very large, generally less flexuous, or decidedly imperfect at some particular point. Sometimes it is hypertrophied, and its convolutions, though simple, are, as it were, piled upon one another, and tend to produce impressions on the internal surface of the cranium. Sometimes it is altogether atrophied, or only so on one side, in its frontal, parietal, or occipital lobes, in its central portions, or in a group of convolutions which we have seen replaced by cellular tissue, or transformed into a cerous cyst. In a case shown to us by Dr. Mierzejewski, the parietal and occipital lobes were so shrunken that the cerebellum was completely uncovered, as in the kangaroo. These apparently contradictory lesions explain why the weight of the brain of lunatics generally has not uniformly exhibited the diminution which we might have expected, as compared with the brains of men of sound mind. It is the same with the cubic measurements of the cranial capacity. The cranium, at the termination of infancy, may remain small, but at adult age and later it is unable to follow the retraction of its contents, and to become less in size. After inspecting 520 crania of insane persons, collected by Esquirol, which form part of the museum of the Anthropological Institute of Paris, and setting aside the probable cases of hydrocephalus, we may safely say that their mean cranial capacity is below the mean in men of sound mind. If one could obtain those of idiots—that is to say, those who have been insane from birth—there cannot be a doubt that we should find it the same in them. Cretins, which are to be found under various names in almost all mountainous parts of the globe, may be placed in the same category as idiots. The immediate cause of cretinism is by no means certain. But how singular that this widespread malady should take place under the influence of external circumstances acting upon the brain of the infant even during intra-uterine life! The head is generally large, the figure that of an aged person, and the nose deeply sunk at the root, which has given rise to a theory of which we shall speak presently."

BIOLOGY.

"Biology." By Dr. Charles Letourneau. Translated by William Maccall; with eighty - three illustrations. London, Chapman & Hall, 193, Piccadilly, 1878.

THIS work is one of the volumes of the Library of Contemporary Science, now in course of issue by the above-named publishers, and the scope and intent of the work is to state concisely what life is, and how organised beings are nourished, grow, are reproduced, move, feel, and think. But although the work is limited within the range of subjects above stated, the author in the preface expresses his hope that the learned men who devote themselves to special subjects may find in his modest production some new combinations, perchance some of those general views which are sometimes lacking to certain men in other respects very distinguished, but who abide too closely in this or that district of knowledge, as happens often in this age when the division of scientific labour is carried to excess. Nevertheless, he does not write for scientific men, and wishes especially to be read by the mass of enlightened people, whom our very incomplete system of public instruction has left almost unacquainted with Biology. In effect, our best establishments for secondary instruction limit their ambition to imparting sufficiently complete ideas of physics, and very incomplete ideas concerning chemistry; but they stop too timidly on the threshold of Biology, the mysteries of which are accessible only to a small number of special men. This is a defect exceedingly deplorable, exceedingly prejudicial to general progress. It is on account of this defect

that so many false and even pernicious ideas continue to find acceptance and empire in public opinion; hence it is, in a great measure, that true philosophy, or rather that philosophy which is alone solid and sound, that which flows directly and legitimately from observation and experiment, has such difficulty in diffusing itself.

The object of this book is to remedy this serious educational deficiency in those who are otherwise enlightened. It is therefore a work of vulgarisation. Certain scientific men, too strictly confined within their own circle, and whose horizon is bounded by the walls of their laboratories, pronounce, with disdain, though unjustly, this term. To find the truth is surely a noble labour; but what is the value of the discovered truth if care is not taken to propagate it, to introduce it into the patrimony of general knowledge?

On the other hand, it must be granted that the work of popularising has been brought somewhat into disrepute by a crowd of pseudo-scientific publications, the authors of which, trusting too little to the intelligence of the reader, either administer only an infinitesimal dose of science, or think themselves obliged to dilute the main idea with a deluge of light or pleasing words, sacrificing thus at once to the most amiable and most dangerous of our national peculiarities. Science only deserves its name upon condition of preserving a somewhat austere nobleness, and in this work care has been taken not to rob science of that which constitutes its strength.

The work, under several divisions termed "Books," treats of organised matter in general; of the primordial phenomena of life; of growth; of generation; of mobility of innervation; and of the physical forces in Biology; and the entire volume is so full of matter demanding attention that it is not easy to select any one portion as more worthy of consideration than any other part of it; but the following, which has reference to the Digestive system, is certainly worthy of notice:—

"A general fact, strange at first sight, arises out of the comparative examination of the digestive system in marine herbivora, whatever may be their place in the natural hierarchy. In effect, in the terrestrial animals, the herbivorous digestive tube is more differentiated, more complex, furnished with gastric pouches, with ceca, vaster and more numerous than the carnivorous digestive tube possesses. The porcupine has as many as fourteen stomachic cavities. Now we observe precisely the contrary in aquatic animals, in which we see herbivorous alimentation generally coinciding with a simplified digestive system. Thus in the herbivorous syprinus there is not even any stomachal distention; and it is the same in the tadpole. The cetaceous herbivora (the lamentine, dugong, &c.) have only one stomach with single or double dilatation, while the cetaceous carnivora (dolphin, whale, &c.), have three, four, five stomachs, and the squalus peregrinus many stomachal cavities. The explanation of this anatomical paradox seems to us easy to give. The general principle is, not that every herbivorous animal must have a more complex stomach, but that every animal must possess a digestive system more differentiated in proportion as its alimentation is more varied; now, in the aquatic mediums, the flora is little diversified. It is almost entirely composed of sea-weeds, plants of very simple structure, of a soft consistency, and of a chemical composition everywhere almost identical. The digestive apparatus of the marine herbivora has then only a uniform work, of relative simplicity, to accomplish, while, on the contrary, the aquatic fauna being extremely varied, the alimentation which it furnishes resembles it; and consequently necessitates a digestive system adapted to render absorbable aliments very

dissimilar from each other. Alimentary variety seems even to be a necessity for certain herbivora, and Magendie has seen rabbits only live fifteen days, that is, die of inanition, when compelled to live solely upon one of the vegetables which constituted their ordinary alimentation (carrots, cabbages, barley, &c.) Besides, we must guard against attaching an absolute value to the denominations 'herbivora' and 'carnivora.' As M. Schiff points out in his excellent 'Traite de la Digestion,' there is no essential difference between the gastric juice of herbivora and that of carnivora. Both disaggregate the vegetal or animal aliments, both dissolve the albuminoidal substances and everything that is soluble in acidulated water. The herbivorous gastric juice is only a little less active, and, though of equal weight, it digests fewer albuminoidal matters than the carnivorous gastric juice. But, by causing a rabbit to absorb, either through the blood or through the stomach, various soluble substances (peptogens) which have the property of rendering the gastric juice more active, we succeed in making the stomach of a rabbit functionate like the stomach of a dog or cat. At all events, the peptones prepared at the expense of the albumin by the stomach of a herbivorous animal are directly assimilable by the tissues of a carnivorous animal, and if we inject them either into its stomach, or direct into its veins, they are perfectly absorbed, and we do not find them again in the urines, as happens with every non-assimilated substance. The identity of the process and the result of digestion in herbivora and carnivora being demonstrated, there is no cause for astonishment in the facility with which a herbivorous animal can become a carnivorous animal, and inversely. The herbivora especially become accustomed without much difficulty to an animal diet. Organised for the greater, it costs them little to accommodate themselves to the less. Numerous facts of this kind have in science an almost common-place notoriety. Spallanzani had accustomed a pigeon to eat meat to such a point that it afterwards refused seeds. The cows and horses of Iceland feed willingly upon dried fish. Horses and oxen accustomed to feed upon fish have been seen to enter the water to fish for themselves. Besides, all the herbivorous mammals are necessarily carnivorous during the period of lactation. Also, during this period, the rumen of ruminants is not yet developed. Amongst the carnivora, the most robust, the most typical sometimes actually refuse vegetal nourishment. The tiger, the lion, the eagle, habitually allow themselves to die of hunger rather than touch it. Nevertheless, Spallanzani had accustomed an eagle to eat and digest bread. Native repugnances can be most frequently overcome by calling in the help of the culinary art. It is, moreover, in a great measure to this circumstance that man owes his omnivorous character. Dogs and cats do not eat corn, but they will eat bread. The rabbit refuses large pieces of raw meat, but it willingly accepts and digests meat minced or boiled. Certain animals are at once carnivorous and herbivorous, as, for instance, a number of birds. Others are frugivorous in winter, and insectivorous in summer. The small frugivorous monkeys eat insects, and seek eagerly for eggs and for little birds scarcely hatched. Moreover, animal species very closely connected in the taxonomy differ in their mode of alimentation. The polypi, like most inferior animals, usually feed exclusively upon animal matters. Even the hydras habitually reject vegetal substances, which their rudimentary organisation does not permit them to assimilate; but the tubularia gelatinosa nevertheless feeds upon the flowers and seeds of the water lentil. Amongst the coleoptera, the plantigrades, and the cetaceans, certain kinds are carnivorous, and others of the same group are herbivorous,

&c. We have already said above that during abstinence every animal becomes carnivorous. It consumes its own tissues, and even its stomach becomes charged, at the expense of these tissues, with a carnivorous gastric juice, destined for the absent aliments (L. Corvisart). Before concluding this very incomplete sketch, it will not be useless to say a few words on geophagy. The earth-worms, the naiads, swallow the humus of the soil; this humus is kneaded by a kind of muscular gizzard, probably diluted with a secretion, and the residuum is rejected in pulpy cords. According to Swammerdam, the larva of the ephemeris eats clay only. Its colour even varies with the colour of the clay. Among the lower beings, geophagy easily explains itself. The vegetal humus, which the earth-worms eat, the moist clay, which the larvæ of the ephemerides also swallow on the banks of the rivers where they live, contain a large quantity of organic detritus and of soluble salts, which alone are absorbed. Geophagy is less easily comprehended in man; nevertheless, independently of pathological cases, there are numerous examples of it. The Otomacs eat, or rather ate, every day, a pound and a half of unctuous and ferruginous clay. Spix and Martius have observed analogous cases amongst various tribes on the banks of the Amazon."

PROCTOR'S ASTRONOMICAL WORKS.

"The Universe of Stars." Presenting researches into and new views respecting the Constitution of the Heavens. By Richard A. Proctor. Second edition. Longmans, Green, and Co., London, 1878.

"Transit of Venus." A popular account of Past and Coming Transits from the first observed by Horrocks, A.D. 1639, to the Transit of A.D. 2012. By Richard A. Proctor. Third edition. To which is added a Note on the results obtained by the British Expedition. London: Longmans, Green, and Co., 1878.

"Other Worlds than Ours." The Plurality of Worlds, studied under the light of recent scientific researches. By Richard A. Proctor. Fourth edition. London: Longmans, Green, and Co., 1878.

THE literary activity of Mr. R. A. Proctor is evidently as great as ever, of which the simultaneous issue of the above-mentioned works affords ample confirmation. As these works are all of them new editions of books of established merit, we must content ourselves by saying that the present editions perfectionate the several works named still further, so that however good the former editions may be, these are better. It may, however, be desirable to state that in the preface to the present edition of "Other Worlds than Ours" Mr. Proctor mentions that he has removed several passages, as they referred to questions which have been decided upon new evidence in the sense advocated in the original text. Further, he has omitted passages from the last chapter as expressing a more confident opinion about matters connected with the supervision and control of the universe than he at present entertains.

The Note on the Results of the British Expedition in the volume on the Transits of Venus is well worthy of perusal, as it shows that Sir G. Airy's views as to the solar parallax being determined as 8".75, 8".76, corresponding to a mean distance of 93,375,000 miles, is open to question. As to this Mr. Proctor says:—

"In point of fact, to allow the new value to displace the mean estimate of former observations, would be equivalent to according to the result a weight exceeding many times that assigned to the best work of many other astronomers."

FOSTER'S CLASS-BOOKS.

"London Science Class-Books." Edited by G. Carey Foster, F.R.S., and Philip Magnus, B.Sc., B.A. — "Astronomy." By Robert S. Ball, LL.D., F.R.S. (Longmans and Co.)

THE little work before us will be of use in the higher branches of schools, it being well adapted for educational use.

THE DRAMA.

As we have occasionally ventured to be in unison with the rejoicing spirit of the Christmas and Pantomime season so far as to pencil cum penna the theatrical attractions of our capital, and as at this season some of them are of a good English character, we will "do so again."

AQUARIUM THEATRE, WESTMINSTER.

"A Frog He Would a Wooing Go" is the title of the pantomime piece exhibited at this theatre. There is an arch old Scotch song, "Ha! ha! the Wooing o't," called up to our mind by this title; and as we watch the frog in bottle-green coat, gold buttons, and wondrous breeches, looking like a fabled darkey king, and making love more expressively than elegantly to fair maidens, we laugh heartily, "Ha! ha! the Wooing o't." However, when a pretty scene descends with a representation of a gem in the way of a frog-pond with Brobdignagian water plants and head-shaped vegetable floaters, not to speak of other aquarium charms; and Monsieur Frog, aided by spangled ladies, fairies, princes and princesses, indulges in harmony with the modern dance accompaniment, the sentiment grows enthusiastic. The transformation scene after this one was "The Abode of Jack Frost." Owing to thoroughness of equipment, of fairies, and light, it was received by Master Edward, Miss Polly, and Mr. Smith with applause. As is customary, a number of children were introduced. They were "got up" a la militaire Français and as English tars, and sang characteristic songs. We must mention the rendering by Mr. W. Simpson of Frog, Miss Hatherley of Papillo, Miss Bonehill of Prince Radiant, Mr. Paulo of Blustero, Miss Adair of Princess Loveliness, and Messrs. Paulo, Mosely, and Talbot of Clown, Pantaloon, and Harlequin.

COVENT GARDEN THEATRE.

The title of the winter piece here is "Pass in Boots." The feature which strikes the observer is the excellent comic rendering before the Harlequinade portion, an instance being a band of four performers, who are dressed in early English style, are marvellously stout, and constitute a band with brass instruments. The co-operation of the orchestra makes the deception complete, and loud but good rendering of funny airs, manufactured for the pantomime, with a cockney tone, occasion great laughter. The pantomime spectacle has a grand effect through ascending arrangements. Fairies revolve and march up, returning by another way, forming living fountains. We must testify approval of the imitations of glass prisms and pendants. The principal artistes were Miss Cook (Fondalin), Mr. Cook, Miss Kearney, and Messrs. Raynor.

HENGLER'S CIRCUS, ARGYLL STREET.

This is held in a beautiful hall, more elegant and comfortable than Astley's, however dear the associations of the latter. On entering, the theatre-goer is struck by the brilliance of the scene, the nice rows of balconies, boxes, and balcony stalls; and if he enter rather late, the effect in the circle within good range, groups of young girls and boys dressed in the ornamental pastoral style of Louis XIV. and XV. of France manoeuvring amongst arrangements of flowers. This is one of the concluding scenes of the pantomime, "Red Riding Hood's Garden Party," which deserves extensive pa-

tronage from young folks. The harlequinade takes the French style of being performed through equestrian and similar feats; and the clown, Little Sandy, with whose portrait all sections of the public are familiar, roasts the staff of military-looking gentlemen à la Franconis, is a capital one. From boyhood's impressionable days most English people have loved to seek the circus in mid-winter time, and we confess to sentiments of genuine pleasure at having once more rolled back time in hurrahing the feats of the sylph as she bounded along, leaping over scarves and heading through paper hoops. The energetic and skilful equestrianism of Miss Adams and Signor Gaertner, the performance on the wire rope of a French lady, and that of the little mule, deserve great praise.

THE PROGRESS OF CIVIL ENGINEERING.

At the first meeting of the Institution of Civil Engineers after the Christmas recess the newly-elected President, Mr. John Frederic Bateman, F.R.S.S.L. & E., delivered an Inaugural Address.

After a passing allusion to the growth of the Institution, which at the end of 1844 numbered only 552 of all classes, now increased to 3,189, reference was made to some of the addresses of the eighteen gentlemen who had previously occupied the presidential chair, mainly for the purposes of comparison. Thus, Mr. Robert Stephenson, in summarizing the statistics of British railways to the end of 1854, mentioned that 368 million sterling had been authorized to be expended, of which 286 millions had been raised; whereas at the end of 1876 these figures were respectively 742 and 682 millions. Again, Mr. Locke, in treating of French railways, remarked that at the close of 1856 concessions had been granted for 7,030 miles, of which 4,060 miles were open; whilst at the close of 1876 these mileages were 16,452 and 12,715. Mr. McClean had contrasted the income available for taxation in 1815 with 1856, and had shown that in the interval the revenue from land had not increased, while that from houses had augmented 300 per cent., and from quarries, mines, ironworks, canals, railways, &c. 1,200 per cent. There was evidence that since 1856 the increase had been very great, even if these high rates had not actually been maintained. These remarks showed how largely the Engineer had been employed, and how much his labours had contributed to the development of the wealth and prosperity of all countries where he had been engaged.

Proceeding to matters more personal to every member of the Institution, the President urged that engineering was but, in fact, the embodiment of practical wisdom; or, in the words of Bacon, "the conjunction of contemplation and action." Thought combined with practice had led to the perfecting of the steam-engine by James Watt, to the successful application of the locomotive engine by George Stephenson, and to the production of the electric telegraph. It was to the combination of sound theory with successful practice, that engineering owed its present position, and had been able to advance material prosperity. It might, however, lay claim to more than that, for the works of the engineer had carried the blessings of civilization into every quarter of the

globe; the steam-engine in its various applications had knitted together the most distant nations, ignorance had been brought into contact with knowledge, and heathenism with Christianity. On these grounds, and on others, the education of the engineer was of serious moment. In France, and on the Continent generally, where public works were mainly carried out by the governments, engineers were educated in special schools, the theoretical information thus acquired being admittedly superior, as a rule, to that imparted in this country; yet the students lacked that practical experience which had hitherto been the main source of the success of the English engineer, who owed little or nothing to Government patronage, and whose employment depended on individual merit, the works being undertaken by private enterprise. Still, our young engineers were not always prepared, by preliminary education, as well as they might be for the subsequent acquisition of practical knowledge. Special qualifications, and some of a high order, were required, and it would be well if advantage were taken of the numerous public schools in which instruction bearing on engineering was given, with a view to prevent young men becoming pupils without these qualifications. But it must be understood that such training could only be regarded as preparatory, and not as being complete in itself; and it was a mistake and mischievous where any college or school professed to fit a student to act at once as an engineer.

The President then gave a brief description of a few of the principal engineering works recently completed, or at present under construction; mentioning in telegraph engineering the telephones of Mr. A. G. Bell and Mr. Edison; instruments which differed in construction, but by both of which the human voice, with all its modulations, could be transmitted to great distances. Then, again, the quadruple system of telegraphy, imported from America, had also come into use. By this system two messages could be sent in each direction by the same wire at the same time. During the past year electricity had put forward other claims than those relating to means of communication. Thus, the electric light, if it could not at present compete successfully with the convenience in domestic arrangements of gas lighting, had been found useful and effective for the illumination of large spaces, and the invention was about to be applied at the Lizard Point Lighthouses.

In the conviction that experience of a special kind, gained during a professional life, was of more real value than allusions, however lucid, to a variety of subjects, the President next adverted to a question which was of the highest importance in that branch of the profession to which his attention had been more particularly directed, viz.:—the rainfall of this country, and the quantity of water which flowed off the ground, available for the use of man if properly utilised, or destructive when uncontrolled and permitted to cause floods or torrents. The variation in the rainfall was very great. For instance, on the east coast of England and Scotland the average did not exceed 20 inches per annum; on the south and west coasts it was 35 or 40 inches; in the Penine chain of hills forming the back-

bone of England, the quantity ranged from 40 to 60 inches; in the highest parts of Wales, Cumberland, and Westmoreland a fall of from 60 to 80 inches was reached, while in some parts of the lake districts it amounted to upwards of 150 inches. The observations of Mr. J. F. (afterwards Dr.) Miller, of Whitehaven, showed that the maximum density of the rain cloud was at about 2,000 feet above the sea level, although local circumstances exercised an important influence upon the quantity of rain which really reached the earth; that the greatest deposition of rain might be expected on that side of a mountain exceeding 2,000 feet in height, upon which the rain cloud impinged, but on the opposite side when the mountains did not rise so high; and that in a succession of ridges and valleys, without intervening mountains of a sufficient height to arrest the progress of the rain cloud, the greatest fall of rain would be in the first trough. In illustration, numerous observations on the rainfall in Lancashire and Yorkshire were given; and it was mentioned that the same results were observed in the lake districts of Dumbarton, Stirling, and Perthshire. As the quantity of rain varied in every district, and depended not only upon elevation but upon the physical and geographical features of the country, nothing could be more fallacious than to attempt to determine, by any fixed ratio, the amount of rain which would probably fall in any district, unless there were some corresponding one, similar in elevation, in proximity to the sea, in exposure to wind, and in other external circumstances with which to compare it. The proportion of this varying rainfall, which would flow off the surface, depended largely upon the geological character of the rocks, their elevation and declivity, and the manner in which they were clothed with vegetation. The water passed off partly in floods, and partly in perennial springs; that issuing from springs varying according to the physical features or lithological character of the district. Absorbent rocks yielded the greatest abundance; next loosely stratified rocks, and least of all the closely bedded slate rocks and the primitive formations. Generally, in the coal measures, the millstone grit, and the primitive formations, the quantity of spring water in the driest seasons would vary from about $\frac{1}{4}$ to $\frac{3}{4}$ of a cubic foot per second per 100 acres; $\frac{1}{2}$ a foot per second per 1,000 acres being an average quantity in a dry season. This quantity formed, however, but a small portion of that flowing off the ground in times of flood, which exceeded five or six hundred to one thousand times the quantity of water in dry seasons. The amount of flood waters was an important consideration in all engineering operations, as upon it depended the supply of large storage reservoirs, for canals, for water power, and for the use of towns,—the openings of bridges spanning rivers, the construction of river courses, the drainage of lands, and the effect in "scour" upon the beds of rivers and upon the mouths of harbours.

THE Great Northern Railway have just adopted for the purpose of lighting their carriages the Davis and Thomas Patent Railway Lamp. This invention affords, it is stated, a light of remarkable purity and intensity.

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SIR DAVID BREWSTER, K.H., LL.D., F.R.S., &c., from the establishment of the INVENTORS' INSTITUTE, till his decease, February, 1868. LORD RICHARD GROSVENOR, M.P.

President, SIR ANTONIO BRADY.

SESSION 1877—1878.

MEMBERS' MEETING.

At a Quarter-past Eight in the Evening,
Thursday, February 7th. Patent Law Conference.

Thursday, February 28th. "Exposition of Inventions." The Executive Council meet at 7.30 p.m. on same days.

Subscriptions are payable to Mr. G. A. STRETTON, the Receiver, 4, St. Martin's-place, S.W., who is the proper official to give receipts. F. W. CAMPIN, Sec.

Proceedings of the Institute.

MEMBERS' MEETING.

On January 10th a Patent Law Conference of Members of the Institute was held; but after the Secretary (Mr. F. W. Campin) had made a statement as to the present position of the question, it was agreed, on the suggestion of Mr. T. Blanchett, to adjourn the consideration of the question to a future meeting, it being thought useless to discuss the matter till Parliament met, especially as the meeting would happen at such an early date.

On January 24th the communication, "On some Improvements applicable to the Permanent Way of Railways," was brought before the meeting; but as the discussion on it was adjourned in order that fuller information on some points in connection with the matter might be obtained, we reserve our report for a future occasion. We may, however, state that the wooden rail and chair wedge patented by Messrs. Sample, Grantham, and Waddle, which came prominently before the meeting on this occasion, appeared to be considered an invention of merit.

EXECUTIVE COUNCIL.

No special business has been transacted by the Executive Council during January.

Monthly Notices.

M. Milne Edwards has been nominated the President of the Scientific Association of France, founded by M. Le Verrier, under whose direction 250,000 francs have been dispensed for the progress of science during the last three years.

The late Dr. R. P. Cotton's Collection of mammalian remains (Pleistocene) from Ilford, illustrating the geology of the Thames valley, has been bequeathed by the deceased gentleman to the Museum of Practical Geology. The collection contains 246 specimens: among them will be found many remains of the mammoth, rhinoceros, the ox and horse (*Equus fossilis*), and some interesting specimens of the lion, bear, and the beaver (*Castor Europæus*).

M. Hervé Auguste Etienne Albans Faye has been appointed Director of the National Observatory at Paris, in succession to the late M. Le Verrier, the duties in the interim having been discharged by the Senior Assistant, the well-known M. Yvon Villarceau. M. Faye, who was born on October 1st, 1814, formerly held an appointment at the Observatory, and was afterwards Professor of Astronomy at the Polytechnic School. He first became known to the astronomical world by his discovery of the periodical comet which has since borne his name on the 22nd of November, 1843. Of his numerous subsequent labours in many departments of astronomy and astronomical physics it is unnecessary here to speak. They are such as to lead us to anticipate that his directorate of the Paris Observatory will be an active one.—*Athenæum*.

The Telephone.—Prof. Tait announced to the Royal Society of Edinburgh, on behalf of Mr. James Blyth, M.A., that sounds will be received by a telephone from which the iron disc has been removed, and a disc of copper, wood, paper, or india-rubber substituted for it.

The Phonograph, or Mr. Edison's telephone, will, it is said, give sounds sufficiently powerful to be heard at a distance of more than 150 feet.

Electrostriction is the name given to a peculiar action on the mercury of a thermometer. If the bulb be chemically coated with silver, and then, by the electrottype process, covered with the same metal, the mercury will traverse some portion of the scale, and finally take up a definite position independently of temperature. Copper, silver, iron, and nickel constrict the bulb, while zinc and cadmium distend it. Prof. Young communicates this to the Royal Society.—*Athenæum*.

Ruhmkorff, who died recently in Paris, was born in Hanover in 1803. In 1844 he brought out his first invention, a thermoelectric battery, and in 1851 the famous "Ruhmkorff Coil," which was rewarded by a medal and decoration at the Exhibition of 1855, and in 1858 received the prize of 50,000fr. at the Franch Exhibition of Electrical Apparatus. M. Ruhmkorff was a member of the French Physical Society.

Professor Abel, the late President of the Chemical Society, and one of the honorary members of the Society of Public Analysts, has been nominated to the Companionship of the Bath. Dr. Playfair, another honorary member, is said to be the only other chemist who enjoys that distinction.

M. Antoine Cesar Becquerel died on the 19th of January, at the advanced age of nearly 90 years. He was born at Chatillon-sur-Loing (Loiret) on the 7th March, 1788. M. Becquerel was educated in the Polytechnic School, which he left as an engineer officer in 1808. He served in Spain and took part in several sieges under the orders of Marshal Suchet. In 1814 M. Becquerel was named Inspector of the Polytechnic School, and he quitted the army in 1815. He was elected a member of the Académie des Sciences in April, 1829, and a corresponding member of the Royal Society of London in 1837, the Copley medal being awarded to him for his researches in electricity. He was Professor of Physics in the Museum d'Histoire Naturelle. A large number of memoirs on different branches of electricity, to which M. Becquerel devoted his especial attention, will be found in the "Comptes Rendus" of the Academy of Sciences.

M. Regnault.—At the same time as the death of the elder Becquerel, was announced the death of another distinguished member of the Institute of France, M. Henri Victor Regnault. He was born on the 21st of July, 1810, at Aix la-Chapelle.

Dr. James Murphy, B.A., has been appointed to the chair of Botany at the University of Durham College of Medicine, at Newcastle-on-Tyne.

THE SCIENTIFIC REVIEW

AND

Scientific and Literary Review.

FEBRUARY, 1878.

INVENTION AND MANUFACTURES.

Two lawyers of high position have recently been informing the public mind on two important matters which have some special interest for us. Sir EDMUND BECKETT has been writing in that leading journal, the *Times*, on the objectionable habits, customs, and action of the working classes as developed by Trades Unionism and strikes; and Sir J. STEPHEN (who in regard to law considered as a science is, perhaps, without a compeer) has been lecturing us *ex cathedra* on General Sir ARTHUR COTTON's admirable suggestions as to Irrigation in India.

Now, neither of these lawyers, in regard to the matters referred to, can be said to have risen beyond what may be termed "the shop;" they speak not as learned and impartial professors; but as partizan advocates. It is not our present purpose to enter into the discussion of the great question of Irrigation in India, which we reserve for a future occasion; but we desire to say something on a subject on which Sir E. BECKETT has publicly pronounced himself in the same Sir ANTHONY ABSOLUTE style as on the working class question, namely, the right of Inventors to legalised remuneration for their genius and labour, under good Patent laws, for the tenor of Sir EDMUND's argument in the workmen's question leads us on to this; the fact being that he regards the status of either class of labourers (for the inventor is a labourer as much as the ordinary handicraftsman is) to be naturally and properly one of serfdom to Capital—that is, what the capitalist likes to give the worker, that he ought to take without question or murmur; in fact, in accordance with the old lines of political thought, the least numerous class is to lord it over the most numerous.

As a political question, this subject cannot be discussed in the pages of the *SCIENTIFIC REVIEW*; but as one affecting the welfare of Inventors and the progress of the manufactures of this country, it is our duty to give it our best consideration, as far at least as the advancement of Invention amongst us is involved.

We have now unfortunately arrived at a time when there is a general lamentation over the depression of our native industries, and in some cases the workers therein are positively in a state of starvation. What is the reason of this? Sir EDMUND BECKETT and other gentlemen of the transcendental school of political economy answer—Strikes! But none of these sciolists turn their attention to the fact that the general spirit of non-encouragement of Invention which pervades the men of capital amongst the business classes of this country has a great deal to do with the unfortunate state of things above referred to. That this is in reality the great secret of the extremity of depression in which some of our manufactures are now placed may, we consider, be well illustrated by the position taken up as competitors in manufactures which we formerly considered peculiarly our own by our American cousins, whose treatment of Inventors and Patent law is just the reverse of our own. To make this apparent we will quote some remarks on the Philadelphia Exhibition in one of the best of the journals in the United States, the *International Review*. It seems, at first glance (says the writer), strange that the United States, which have so long occupied a defensive position (protective) in most branches of industry, should so easily have reached and so long maintained a control of the market, not only at home but throughout the world, in lines of production like those just enumerated, viz., agricultural implements, small-arms, sewing machines, scales, locks and safes, &c. The reason, however, is

not far to seek. Although Americans were the original inventors (at least in the practical sense) in nearly all these departments, in respect not only to the fundamental mechanism, but also to the numberless small additions, modifications, and devices (for instance, over two thousand patents have been issued by the United States Government for sewing machines and sewing machine attachments), in which oftentimes is found the whole difference between success and failure, yet this is not the sole, or even, as I am disposed to esteem it, the chief reason for the superiority of these machines and implements as manufactured here, over those made in competition with them or in imitation of them abroad. It is not so much in making machines as in making machinery to make machines, that we surpass all other nations in a degree not easily to be expressed.

In the manufacture of machinery for working wood and metal (always excepting those for the manufacture of the heavy armour plates required in model naval warfare, and for building up the giant guns at present in use), the United States are not even closely approached by England or Germany. It is not so much to inventions directly relating to the scale, the rifle, the sewing machine, that we owe our superiority, as to the fact that we invent and build machines which produce the several parts of our scales, rifles, and sewing machines, of absolute precision and entire interchangeability, with a far less expenditure of labour and waste of material than other nations encounter in producing the parts of their corresponding implements and machines comparatively rough and clumsy, and only in a low degree, if at all, fitted for mutual substitution in case of repair.

The world owes, if not the principle of interchangeability in machinery, at least its full realization to the United States, where it was first applied on a large scale by Whitney to fire-arms. While other nations have slowly taken it up, the principle has been carried forward by our machine builders and tool makers into almost every department of production with a degree of success truly astonishing.

The two exhibits at "the Centennial" which most strikingly illustrated the triumph of American industrial genius in this department were almost at the two extremes of production. The exhibit of William Sellers and Co., of Philadelphia, may be taken as containing the highest achievements in metal working machinery of great power, yet of the most minute precision. "This exhibit," writes Dr. John Anderson, of Woolwich, England, "when considered in regard to its extent and value, its extraordinary variety and general excellence, as also for the large amount of originality that is shown in the numerous new devices that are introduced, is probably without a parallel in the past history of International Exhibitions, and, taken as a whole, it is worthy of the highest honour that can be conferred."

Widely enough contrasted with these powerful machines was the exhibit of the American Watch Company of Waltham. The exquisite delicacy of this machinery almost surpasses belief, the workman in some departments requiring powerful lenses to enable him to follow the movements, and the nicest apparatus to enable him to take up the product. It is stated that some of the screws manufactured by the machinery of this company number 150,000 to the pound, the threads being more than two hundred to the inch.

It is true that the author of this paper goes on to speak of the prevalence amongst American workmen of what may be termed superior technical education as contributing to the success of American industry; but it is clear from what he states the inventive spirit is full well encouraged in the United States; hence the success attained, and unless the manufacturers of this country are prepared to treat inventors in a similar spirit to that prevalent in the United States, so as to encourage even our working men to aid us in our industrial career, we must inevitably fall into the rear.

Proceedings of Societies.

ROYAL SOCIETY.

DEC. 20TH.—Dr. A. Thomson, V.P., in the chair. The following papers were read:—"Notes on Supersaturated Saline Solutions," by Mr. C. Tomlinson; "Notes on Physical Geology, No. III. On a New Method of finding Limits to the Duration of certain Geological Periods," by Rev. Prof. Haughton; and "On certain Movements of Radiometers," by Prof. Stokes.

JAN. 10TH.—Sir J. Hooker, President, in the chair. The following papers were read: "Magnetic Observations taken during the Transit of Venus Expedition to and from Kerguelen Island," by the Rev. S. J. Perry; "On the Structure and Development of the Skull in the Common Snake (*Tropidonotus natrix*)," by Mr. W. K. Parker; "Observations on the Nervous System of *Aurelia Aurita*," by Mr. E. A. Schafer; and "On the limits to the Order and Degree to the Fundamental Invariants of Binary Quantics," by Prof. J. J. Sylvester.

ROYAL SOCIETY OF LITERATURE.

DEC. 17TH.—C. Long, Esq., in the chair. Mr. W. de Grey Birch read a paper "On a very rare Saxon Document"—an original Charter of Uhtred, the Sub-Regulus of the Wiccii, or people of Worcestershire, to Ethelmund, the Minister of Offa, which has been recently discovered in the Library of the Dean and Chapter of Worcester. Its date is probably in the reign of Offa, in A.D. 791-6, and, apart from its antiquity, is of great interest, as very closely resembling, in its handwriting, a grant of Offa himself, published by the British Archaeological Association in their "Journal" for 1876, p. 190. The grant is that of a piece of land in the "vicus" of Easton, and was to be held by the ordinary Saxon holding of three iives, to revert ultimately to the Cathedral Church of Worcester.

ANTHROPOLOGICAL INSTITUTE.

DEC. 11TH.—J. Evans, Esq., D.C.L., President, in the chair. Dr. J. F. N. Wise was elected a member. Mr. W. Smith exhibited some objects from Maiden Bower, and a series of camera-lucida drawings of several stone monuments in Wales. Mr. A. Jukes Browne exhibited a series of flint flakes, scrapers, and arrow-points from Egypt, and read an interesting paper on the subject. He described the geological formation of country round Helwan, about sixteen miles south of Cairo, whence the flints were obtained, and explained the denuding action of the Nile in this locality. He thought that the finding of separate kinds of implements in each site pointed to their having been flint manufactories on those spots, which moreover were near the hot springs. No adzes or celts were found, but fragments of horses' teeth, split into long pieces, were among the flints. The flints used in the manufacture of these implements were pebbles found on the lower plateau, which had been washed down from the hills of Eocene limestone above, the upper beds of which abound in siliceous concretions of various sizes. Mr. Jukes Browne also exhibited some flint implements from a site on the borders of the Fens in Lincolnshire, which appeared to have been a station or manufactory similar to those at Helwan. The President and Mr. Moggridge made some remarks on the above. Mr. J. Park Harrison communicated a further report "On the 'Cave-I't' at Cissbury."

NUMISMATIC SOCIETY.

DEC. 20TH.—J. Evans, Esq., D.C.L., President, in the chair. The following gentlemen were elected members:—Messrs. A. D. George, A. Grant, and Lieut.-Col. J. G.

Sandeman. Mr. Evans exhibited a memorial medal in silver, cast in two separate pieces, probably from wax models, and tooled. Obv. IN REMEMBRANCE OF IOSIAS NICOLSON. Three-quarter bust in flowing peruke to left, two skulls above and two at the sides inserted in the inscription. Rev. a skeleton to the left, digging. MEMENTO MORI in sunk letters. Mr. Hoblyn exhibited a pattern of the first penny of George the Third, by Pingo. Mr. Copp exhibited a forgery of the sovereign of Charles the First, struck at Oxford in 1643. Mr. Cochran-Patrick communicated the second portion of a paper on the Metallic History of Scotland, and Mr. A. S. Gill an account of the hoard of Edward the Confessor's pennies found at Sedlescombe, near Battle.

STATISTICAL SOCIETY.

DEC. 18TH.—Dr. W. Guy in the chair. Mr. E. Seyd submitted a series of large diagrams illustrating the accounts of the Bank of England, the Bank of France, the German Reichsbank, and those of the banks of Austria, Holland, Belgium, Italy, and Russia, explaining the policy of these institutions and other systems of bank-note issue. Messrs. R. B. Martin, W. Newmarch, R. Giffen, and others joined in the discussion that followed.

METEOROLOGICAL SOCIETY.

DEC. 19TH.—Mr. S. H. Eaton, M.A., President, in the chair. Commander E. G. Bourke, Messrs. J. A. Douglas, W. H. La Touche, G. J. Pearce, W. S. Rogers, and W. Tyrer were elected Fellows. The following papers were read:—"Notes on the Meteorology and Physical Geography of the West Coast of Africa, from Cape Verd to the Cape of Good Hope," by Commander E. G. Bourke. This paper gives the results of the observations which the author made during the five years he was stationed on the above coast; "On the Meteorological Observations made by the Norwegian Deep-Sea Exploring Expedition in the North Atlantic in 1876 and 1877," by Prof. H. Mohn. This expedition has been organised in order to carry out for the North Atlantic and the Arctic Ocean an inquiry similar to that conducted by the Challenger Expedition. The vessel employed was the *Voringen*, of 400 tons burden, and the period the summer months of 1876 and 1877. The barometrical observations were taken at first with a mercurial barometer, and afterwards with an aneroid, which was compared daily with the mercurial barometer on board. The temperature was obtained by a special screen hoisted upon the fore-stay. It was found that this gave very satisfactory results. The experiments conducted with a screen similar to that used by our Meteorological Office on ship-board gave readings too high when the sun shone on it. The sling thermometer was also tried, and gave a temperature on the mean a shade below the screen in the rigging. The wind observations were taken with an anemometer at length, and Prof. Mohn describes his own anemometer at length, and deals with its corrections in detail. The speed of the ship was determined by a special logging machine, and by this means and the anemometrical observations the true motion of the wind was ascertained. The part of the paper which presented most novelty was that referring to the evaporation of the sea-water. The paper concluded with tables of the diurnal range of the various meteorological elements for the period of observation. "Report on the Phenological Observations during 1877," by the Rev. T. A. Preston. "Note on a peculiar Fog observed at Kew on October 18th," by Mr. G. M. Whipple.

QUEKETT MICROSCOPICAL.

DEC. 28TH.—Dr. J. Matthews, V.P., in the chair. Four new members were elected. A

paper was read by Mr. Cottam, "On the new Autographic Process," in which he described its points of difference from ordinary lithography, and showed its great superiority to that process as a means of illustrating the finer details of microscopic drawing. A paper was also read by Mr. Hartog, "On the Investigation of Floral Development." A discussion followed, in which Messrs. Gilbert, Ingpen, White, Hartog, and the chairman took part.

GEOGRAPHICAL SOCIETY.

JAN. 14TH.—Sir R. Alcock, President, in the chair. The papers read were: "On his recent Journey to the Yenisei and Ob," by Mr. H. Seebohm; and "On the Geographical and Economical Features of the Transvaal," by Mr. F. B. Fynney. The following gentlemen were elected Fellows: Major-General J. Puckle, Captain Savory, Rev. J. F. Schön, Messrs. S. Clark, L. V. Loyd, S. Macdonnell, E. E. Nicholson, H. Seebohm, and H. F. Weiss.

GEOLOGICAL SOCIETY.

JAN. 9TH.—Prof. P. M. Duncan, President, in the chair. Messrs. E. Brunt, T. W. Cowan, and H. Fox were elected Fellows. The following communications were read: "On the Great Flat Lode, south of Redruth and Camborne," "On some Tin Mines in the parish of Wendron, Cornwall," "On some of the Stockworks of Cornwall," by Dr. C. Le Neve Foster; and "On the Precarboniferous Rocks of Charnwood Forest," Part II., by the Rev. E. Hill and the Rev. T. G. Bonney.

DEC. 19.—Prof. P. M. Duncan, President, in the chair. Messrs. W. Fream, J. G. H. Godfrey, H. Goss, and J. F. L. Rolleston were elected Fellows. The following communications were read: "On 'Argillornis longipennis,' Owen, a large bird of flight, from the Eocene Clay of Sheppey," by Prof. Owen; "Contributions to the History of the Deer of the European Miocene and Pliocene Strata," by Prof. W. B. Dawkins; "On the Occurrence of Branchipus (or Chirocephalus) in a Fossil State, associated with Archæoniscus, and with numerous Insect-remains, in the Eocene Freshwater Limestone of Gurnet Bay, Isle of Wight," by Mr. H. Woodward; and "On the Chronological Value of the Pleistocene Deposits of Devon," by Mr. W. A. E. Ussher.

LINNEAN SOCIETY.

DEC. 20TH.—Prof. Allman, President, in the chair. Dr. Masters made some remarks on a specimen of "Colletia cruciata," received from Signor Fenzi of Florence. In this case, from the same branch there proceeded shoots with broad flattened deltoid spines, characteristic of *C. cruciata*, but also others with slender or cylindrical spines, very similar to, but more slender than, those of *C. spinosa*. Mr. W. G. Smith likewise made some remarks on a fossil Fungus. He also exhibited drawings of *Boletus submentosus*, stating that in a specimen five inches in diameter there are 17,000 pores or tubes. Each pore, when cut across, shows 2,000 cells on the surface. The number of surface cells on the under side of a specimen is 36,000,000. The cells in an entire plant are calculated to be 615,000,000,000, and the number of spore produced by the same specimen, 5,000,000,000. Mr. S. W. Silver exhibited vegetable products, poisoned arrows and other weapons, &c., from the Fiji Islands and New Caledonia, collected by Consul E. Layard. A paper was read "On the Anatomy of the Elk (*Alces machlis*)," by Prof. M. Watson and Dr. A. H. Young. In this a full account of the organs of digestion, generative system, myology, &c., was given, preceded by remarks on the literature of the subject. An abstract of a communication by Dr. J. S. Baly, "De-

scriptions of new Genera and Species of Phytophagous Coleoptera," was read by the Secretary. In a paper "On the Algae of the Arctic Expedition," by Prof. Dickie, it was noted that of fresh-water species there are in this collection representatives of fourteen genera, many of which are common to Europe. Of Diatomaceae thirty-one genera and seventy species have been identified, most being marine. Seven species of olive-coloured Algae are given, but it seems no marine examples belong to the red series among those obtained, the area embracing 78 deg. to 83 deg. N. lat. Then followed a memoir "On Stromatopora," by Prof. A. Nicholson and Dr. J. Murie. Besides already known genera, the authors now add Clathrodictyon, Stylodictyon, Pachystroma, and Dictyostroma, with species under each. They believe the Stromatoporoidea to have been originally calcareous, and not siliceous, as some maintain. They discard the notion of alliance with Corals, Hydrozoa, or Foraminifera, showing wherefore their difference in absolute essentials. To certain of the Polyzoa some examples hold a striking resemblance (as with corals), and possibly further research may bridge difficulties. Meantime this step is not justified. Neither do horny, siliceous, or calcareous sponges, as at present understood, cover structural peculiarities, though sponge organization seems to predominate. In this case, absence of spicules, &c., separates Stromatoporoidea from the existing Calcispongia, so only by negative evidence can a new order of calcareous sponges, Stromatoporoidea, be found.

ASTRONOMICAL SOCIETY.

JAN. 11TH. — Mr. Huggins, President, in the chair. The Rev. W. H. Allen, Mr. T. H. E. C. Espin, the Rev. D. Fleming, Mr. F. R. Janisch, Colonel H. S. Knight, Mr. A. Marth, Mr. G. F. Riddiford, the Rev. P. R. Sleeman, and the Rev. G. E. Watts were elected Fellows. A paper, by Mr. Denning, was read "On Suspected Repetitions, or Second Outbursts from Radiant Points, and on the Long Duration of Meteor Showers." Mr. Denning has determined the radiant points of 2,690 shooting stars observed by himself and of several thousand meteors which have been observed by the members of the Italian Meteoric Society. From these he finds that upwards of twenty radiants remain active for periods of three months or longer, some of them subsiding and bursting out again. Captain Tupman said that Mr. Denning's deductions had evidently involved considerable labour, and that as the results of observations they deserved attention; but it was evident that if the Earth were more than a few days in passing through a stream of meteors the radiant point would materially change in position; and that meteors appearing to come from the same part of the heavens after a lapse of three months would be travelling in very different orbits. The whole question, therefore, seemed to turn on the degree of accuracy with which the radiant points had been determined. Dr. W. Erck described some improvements in a spectroscope now being constructed by Messrs. Grubb for Professor Young. The chief novelty consisted in the power of focussing the collimating lens upon the slit for different parts of the spectrum by the same movement of the pinion-screw which adjusts the focus of the observing telescope. Another improvement is that the image of the Sun is caused to fall upon a parallelogram of glass, and after two internal reflections is displayed by a distance corresponding to the radius of the Sun, so that by merely revolving the parallelogram any part of the Sun's rays may be brought upon the slit. Mr. Common described his observations of the satellite of Mars made with an eighteen-inch silver on glass reflector. He described the outer satellite as appearing red like the planet. Mr. Waters read a paper "On the Distribution of the

Fixed Stars of the Southern Hemisphere in Space." He had constructed from the star gauges of Sir John Herschel a map on the equi-surface projection, and had filled up the intervening spaces with shading proportionate to the number of stars in the adjacent gauges. The position of the Milky Way came out as a much more marked feature than upon Mr. Proctor's map of the Northern hemisphere; but it must be remembered that the Bonn Catalogue from which Mr. Proctor's map was constructed was made with a telescope of only 2½ inches diameter, whereas Herschel's star gauges were made with an 18½ inch reflector.

THE INSTITUTION OF CIVIL ENGINEERS.

JAN. 15TH. — The newly-elected President, Mr. J. F. Bateman, delivered an inaugural address, which we give in another column.

JAN. 15TH. — Mr. J. F. Bateman, F.R.S., the President, in the chair. It was announced that the Council, acting under the provisions of the bye-laws, had transferred Messrs. Philip Barry, Thomas Carrington, Alfred Chapman, James Gregson Chapman, Richard George Coke, William Dean, Joseph Edward Fisher, George Fowler, Charles Browne Goldson, M.A., Charles Foote Gower, Jabez James, Edward John Lloyd, Walter Henry Maudslay, William Morris (Deptford), William Morris (Westminster), George Gordon Page, William Edmund Rich, Charles Sells, David Thomson, and Frank Napier Thorowgood, from the Class of Associates to that of Members; and had admitted Messrs. John Francis Albright, Albert Francois Louis Alliman, Charles Henry Barratt, William Henry Barrett, James Trembath Boase, Alfred Box, Reginald Pelham Bolton, Joseph Prendergast Coy, Alexander Stewart Forbes, Ernest Hall Hedley, William Inglis, Augustus Worthington Jopp, George Lloyd, Joseph William Parry, Frederick Reilly, Richard Cotton Rowley, Dukinfield Henry Scott, Arthur Sackville Thomson, Charles Arrow-smith Walsh, Thomas Henry Williams, and Otway Edward Woodhouse, as Students. The monthly ballot resulted in the election of seventeen candidates, viz., Messrs. Cosmo Innes, Ex. Eng., P.W.D., India; George Stanton Provis, District Locomotive Superintendent, E.I. Railway, Jumalpoore; and David Monro Westland, Edinburgh, as Members; and Messrs. George Dundas Churchward, Stud. Inst. C.E., Dover; John James Henderson, City Surveyor of Lincoln; Franklin Hilton, Engineer to the Ebbw Vale Steel and Iron Co.; John Lakeman Hodge, Plymouth; Edward Hodges, Ex. Eng., P.W.D., India; Richard Jaques, Locomotive Superintendent of the Copiapo and Caldera Railway, Chili; Andrew Jamieson, Eastern Telegraph Co., Malta; John Frederick Lewis Jetter, B.A., Westminster; Harry Robert Kempe, Stud. Inst. C.E., P. O. Telegraph; Henry Oliver, Assistant Engineer, Ceylon Government Railways; Henry Peacey, Stud. Inst. C.E., New Cross; Thomas Bawden Provis, Camborne; William Henry Venables, late Resident Engineer of the Ghesa Water Works; and William Weaver, Engineer and Surveyor to the Kensington Vestry, as Associates.

CHEMICAL SOCIETY.

DEC. 20TH. — Dr. Gladstone, President, in the chair. The following papers were read: "On the Constitution of the Terpenes and of Camphor" and "Communications from the Laboratory of the London Institution," by Dr. Armstrong. "On the Hydrocarbons from Pinus Sylvestris, with Remarks on the Constitution of the Terpenes," by Dr. Tilden. The author has examined the terpenes from Russian Turpentine Oil and Oleum roliorum pini Sylvestris. He considers that there are probably only three isomerides amongst the natural terpenes, and suggests a formula for these bodies de-

rived from that of diamylene. "On Citric Acid as a Constituent of imperfectly ripe Mulberry Juice," by Dr. Wright and Mr. Patterson. This juice was found to contain 26.83 grains of citric acid and 3.26 grains of potash salts per litre. The authors point out that it may be valuable as an antiscorbutic, and as a substitute for lime-juice. "On Cuprous Chloride and the Absorption of Carbonic Oxide and Hydrochloric Acid Gas," by Mr. J. W. Thomas. The author suggests a ready method of making a solution of cuprous chloride for gas analysis, but finds that although a solution of this salt absorbs carbonic oxide readily, 63 per cent. of the gas may be again liberated on neutralizing the solution with potash. To avoid such an error he neutralises the solution of cuprous chloride with ammonia, and in this way prepares a solution which introduces into the absorption tube neither free ammonia nor free acid, but which absorbs carbonic oxide with facility. The author has also observed that a saturated solution of ammoniac sulphate absorbs hydrochloric acid gas with great readiness, forming an acid salt and ammoniac chloride.

MATHEMATICAL SOCIETY.

JAN. 10TH. — Lord Rayleigh, President, in the chair. Mr. F. B. W. Phillips was elected a Member. The following communications were made: Mr. J. Hammond "On the Meaning of the Differential Symbol D^n when n is Fractional." Profs. Cayley and Lloyd Tanner took part in a discussion upon the paper. Prof. Lloyd Tanner "On Partial Differential Equations with several Dependent Variables." Lord Rayleigh "On the Relation between the Functions of Laplace and Bessel." Mr. Roberts added one or two results in continuation of his paper read at the December meeting. Prof. Cayley gave an expression for the surface of an ellipsoid due to Prof. Tait. The Chairman, Profs. Cayley and Tanner, and Mr. Webb spoke on the subject.

PHOTOGRAPHIC SOCIETY.

JAN. 8TH. — J. Glaisher, President, in the chair. Papers were read "On the Theory of the Destruction of the Undeveloped Photographic Image," by Captain Abney; "On the Production of Enlarged Photographs of Microscopic Objects," by Mr. E. Viles; and "Stray Thoughts on the Exhibition," by Mr. E. Cocking.

SOCIETY OF BIBLICAL ARCHEOLOGY.

JAN. 8TH. — Dr. S. Birch, President, in the chair. The following Council and Officers for the ensuing Session, 1878-9, were duly elected: President, Dr. S. Birch; Vice-Presidents, J. Bonomi, Rev. F. C. Cook, Rev. G. Currey, the Right Hon. W. E. Gladstone, M.P., his Excellency Sir W. Gregory, the Right Hon. the Earl of Harrowby, W. Morrison, C. T. Newton, Sir C. Nicholson, Bart., Rev. G. Rawlinson, Sir H. C. Rawlinson, and Very Rev. P. Smith; Council, Rev. Canon Beechey, T. Christy, A. Cates, R. Cull, R. Cust, C. D. Fortnum, R. E. Graves, C. Harrison, Rev. W. Houghton, H. Howorth, Rev. A. Loewy, F. D. Mocatta, J. M. Norman, W. Papworth, P. Le Page Renouf, Rev. W. H. Rule, Prof. C. Seager, Rev. H. G. Tomkins, Rev. G. A. Trevor, and Prof. W. Wright; Librarian, W. Simpson; Treasurer, W. B. Bosanquet; Secretaries, W. R. Cooper and A. Cates; Hon. Secretary for Foreign Correspondence, Rev. A. H. Sayce. The President, in announcing the death of the late Treasurer, Mr. J. W. Bosanquet, took occasion to describe the loss sustained as one almost irreparable, when the talents and personal characteristics of the lamented gentleman were considered. To Mr. Bosanquet the Society was indebted for the payment of nearly one-half the cost

of its "Transactions," besides liberal assistance in many other matters. Assyriology lost in him one who was, in the words of his rival, Dr. Oppert, "the Mæcenas of Assyriology." The late G. Smith was urged into publicity by his generosity, and to his patronage several of the rising school of Assyriologists owe their introduction to literary notice. Thoughtful to the last, he had on his death-bed taken measures to hasten the publication of the new part of the Society's "Transactions," the last pages of which would now, alas! have to bear tribute to his rare talents as a chronologist, his discretion as a patron, and his courtesy as a member of Council and a controversialist. The following papers were read: Secretary's Report, Session 1876-7; "Is Biblical Poetry Acrostic?" by Mr. S. M. Drach; and "Revised Chronology of the latest Babylonian Kings," by Dr. J. Oppert.

HISTORICAL SOCIETY.

JAN. 10TH.—Dr. B. W. Richardson in the chair. Nine members were admitted. The Chairman stated that Lady Burdett Countess, who had lately joined, had presented the Society with a large number of books, including the 116 volumes printed by the Camden Society. Dr. Rogers read a paper, entitled "The English in Muscovy in the Sixteenth Century," by the Baron de Bogouskevsky, of Russia; Mr. O. Newman read "Notes on Druidism;" and Mr. G. Hurst a paper "On the Ancient Corporation of Bedford."

BRITISH ARCHÆOLOGICAL ASSOCIATION.

JAN. 2ND.—T. Morgan, Esq., Hon. Treasurer, in the chair. Mr. H. R. Hughes was elected a Member. Mr. L. Brock exhibited some wave-marked Roman tiles, found in Newgate Street, on the spot where the Roman wall was discovered last year. Mr. T. Blashill exhibited two small earthen pots for unguents and a silver coin found in Herefordshire, but without date; and Mr. G. R. Wright a small cinerary urn, with pieces of red and white tesserae, part of a roof-tile, fragments of Samian ware, nails, &c., taken from the Roman villa lately discovered at Abinger, near Dorking. Mr. Wright, in commenting on this "find," made the following remarks:—"Roman villas, or their remains, have not been frequently found in Surrey, and in the part of the county where this villa has been partially uncovered not at all. Many years since, at Walton Heath, the remains of a villa were brought to light, and much later on, at White Hill, Bletchingley, Woodcote, near Sutton, and at Oxted, close by Titsey Place, similar remains were discovered. Such being the case," Mr. Wright continued, "it may fairly be assumed that other discoveries of a similar description will be made in the same neighbourhood, since not only is there a 'Cold Harbour,' a name that betokens the existence of a Roman outpost or station, according to many writers, close by, but also because in such a commanding part of the county, being under Leith Hill, and on the high road to Regnum, the city of Cogidubnus, King of the Regni, and Legate of the Emperor Claudius, many of his officers would select such a neighbourhood to build their villas in and live that life of luxury in them which the celebrated remains at Bignor—the 'Ad Decimura,' or station at the tenth milestone from Regnum—to this day indicate they did. Bignor, from Abinger, lies in a southerly direction, and is about thirty miles off." Mr. Wright then proceeded to say "that, through the invitation of Mr. B. Hicklin, of Rose Hill, Dorking, a member of the Association, several gentlemen of that body made an inspection of the remains of the Abinger villa the previous week, and that although Mr. T. H. Farrer,

to whom this discovery is owing, was unfortunately away, they not only took measurements and made a plan of the atrium, which is floored with small red tesserae, but also of the three chambers at present uncovered, two lying to the north-east and the other south-west of the atrium. At Mr. Farrer's residence, Abinger Hall, they examined the nucleus of a museum he has formed of the relics found in the 'villa.' They consist of coins, silver and bronze, one or two of Constantine and one of Faustina, pieces of red and white tesserae, cinerarii, and fragments of pottery, including some good Samian ware, tiles, nails, and shells, the latter being chiefly the large white Helix, for which this part of Surrey is famous, and the oyster, both so commonly found in the remains of Roman dwellings in Britain." In concluding his remarks, Mr. Wright stated "that, in his opinion, a good pavement or two would yet be uncovered, as in the direction of the peristyle and larger rooms adjacent of a Roman villa the ground remained untouched, and there were indications plainly enough to be noticed of 'continuing walls' running to the south-east, where remains of such apartments would, without doubt, be met with in the present one. Unfortunately, in the piece of the field south-west and east of the atrium, and separated from the portion of it yet uncovered by a hedgerow, great quantities of stones, tiles, and bricks had, before the importance of the discovery was realised, been dug up and carted away, whilst converting it into a kitchen-garden, and it is therefore possible that the hypocaust, the baths, and other 'offices' of the building, from the many pieces of flue tiles and red tesserae lying about, have been interfered with and destroyed." Thanks were voted Mr. Wright for his paper, as well as to Mr. Hicklin for bringing up so interesting a subject before the Association. Papers were then read "On a Roman Fort recently discovered at Beddgelert, North Wales," by Mr. J. W. Grover; "On Ancient Herbal Folk-lore," by Mr. W. G. Black; and "On Ancient Sculpture in Breadwell Church," by Mr. A. Wallis. After several remarks had been made on these various subjects Mr. G. R. Wright, as the oldest officer present, paid a fitting tribute to the memory of his illustrious namesake, Mr. T. Wright, who, as one of the founders of the Association, and for many years one of its chief supporters, deserved at their hands the fullest recognition.

MICROSCOPICAL SOCIETY.

JAN. 2ND.—Dr. J. Millar in the chair. Mr. G. P. Price was elected a Fellow. Messrs. W. T. Suffolk and R. T. Lewis were appointed Auditors, and nominations of Officers and Council to be elected at the ensuing anniversary were made. A paper was read by Dr. Bartlett, "On the Detection of Toxic Matter connected with Typhoid and other Enteric Fevers," in the course of which he gave an account of his attempts to trace to its ultimate source the cause of a recent outbreak of typhoid fever, and showed that whilst chemical analysis had failed to discover any impurity either in the water or milk, he had been able, by means of microscopical examination, to detect in the water certain bodies, presumably of a fungoid character, which were identical with those found in the bowels of persons who had succumbed to the disease. A discussion took place, in which Mr. Stewart, Dr. Bartlett, Dr. Matthews, Mr. Slack, and the Chairman took part. Mr. Slack brought before the meeting a section of bone of "Megalosaurus Bucklandii," and its remarkable resemblance to the structure now identified as peculiar to birds was pointed out by Mr. C. Stewart, who illustrated his remarks by coloured drawings on the black-board.

SIR WILLIAM STIRLING-MAXWELL, BART.

THE decease of this gentleman deserves a passing notice in the world of literature. He was favourably known as the author of "Songs of the Holy Land," published in 1846. His "Cloister Life of the Emperor Charles V." appeared in 1852, and was immediately received with favour, both by the reviewers and the public. In 1855 Sir W. Stirling-Maxwell published "Velazquez and his Works," not Velazquez, as most English people write the name, much to the annoyance of the artist's biographer. In 1856 appeared "Notices of the Emperor Charles V. in 1555 and 1556, selected from the Despatches of Federico Badoer, Ambassador from the Republic of Venice to the Court of Bruxelles." Two privately printed works of Sir W. Stirling-Maxwell's appeared in 1860, viz., "An Essay towards a Collection of Books relating to Proverbs, Emblems, Apophthegms, Epitaphs, and Anas, being a catalogue of those at Keir;" and "An Essay towards a Collection of Books relating to the Arts of Design, being a Catalogue of those at Keir." He was the author of several other books printed in a luxurious style, and intended, originally at least, for private circulation only, some relating to the victories and processions of Charles the Fifth, and others upon topics quite dissimilar, such as his reproduction in fac-simile of the anatomical plates of Vesalius, with a life of Vesalius, printed in 1874.

FOREIGN SCIENCE.

THE Scientific Association of France, founded by Le Verrier thirteen years ago, has now named M. Milne-Edwards for its President. Under direction of the former it spent £12,000 in advancing science, and realised from it about double that amount. It is well that virtue is not always its own reward. This association lays itself out for volunteer gifts. It meets annually at Paris. M. Tissandier and a number of savants are in ecstasies just now over a new captive steam balloon (very large, capable of carrying a numerous pleasure party), constructed by Giffard for 1878. Tissandier says:—"The solution of the great problem of aerial navigation no longer demands the discovery of a principle."

M. Chasles has just presented to the Academy, on the part of Prince Boncompagni, the September, October, and November numbers of the "Bulletino de Bibliografia," &c. The first contains an extremely extensive table of recent scientific publications in all languages. The November one contains divers unedited writings on the system of Abacus—decimal arithmetic, with nine figures taking values by position. It is a German work by Treutlein, Professor in the Gymnasium of Carlsruhe, translated into Italian. The nine figures have the form and the names which are found especially in the MS. of the library of Chartres.

M. de Lesseps announces to the Academy that the staff and baggage of the first scientific and hospital station of the International African Association, founded by the King of the Belgians, has just arrived at Zanzibar.

One of the greatest works known in marine engineering has been accomplished within the last few years—the draining of Lake Fecchino, in Italy, which has gained a surface of 15,775 hectares. The expense was 43,137,209 francs. One hundred colonist's houses, with 25 hectares of ground, will be established. Great experiments are being made in producing characters upon and otherwise dealing with glass. Lament has been made of the falling off in Switzerland of its famous wood-carving, and exertions are being made to recoup. Belgium has

produced latterly good specimens, especially at Louvain, with Gothic and rich ornamentation. Swedish wheel-tyres in Bessemer steel have been exhibited. One is a wheel of a locomotive which has served 10½ years, and which has gone over a distance of 316,502 kilos., has still 41 millims. of thickness, and is still perfectly useable. Some valuable reports have been presented to the Commissary-General and Federal Council of Switzerland upon machinery by MM. Goeldy, Guyer, and John E. Icely. These Swiss gentlemen are filled with admiration at the American machinery which was exhibited at Philadelphia. One of them says:—"Let the human mind once more consider calmly what ideas and execution there were in the admirable American machinery, and it could not deny the approach of an important change. The productive force of automatic machines, extending rapidly, will become imposing. All humanity will be then overpowered with productions which, let us hope, will turn to its blessing." This is elevated language.

The Amazon Steam Navigation Company, which is concerned in increasing the commerce of Bolivia, Peru, and Brazil, are making rapid strides with their navigation scheme. They have an office in Gresham House. As the Government of Brazil has legislated much and rather wisely on the subject of patents, it is to be hoped that inventors of useful matter will be found taking advantage of same.

INDUSTRY AND ART IN LONDON.

(BY A CORRESPONDENT.)

CONCRETE HOUSES.—These are a novelty. Among the instances in which they have been adopted are sixteen cottages at Croydon and a workman's hall at Carshalton. Some of these cottages are of two and three storeys; architecturally pretty; somewhat in Early English style; in some instances having open-timbered work, like the pointed country houses near Manchester. The general effect is that of a little villa. On more particular observation we find there are several doors. One advantage lies in inexpensiveness as compared with bricks. In regard to cottages of three storeys, the great point of novelty is in the walls. They are an inch thick in the thinnest part. The slabs should be made three feet broad by two feet high, because easy to handle, and weighing about 50lbs. The face side is cast in a mould to resemble wall tiling, and stained red. The slabs are secured with ordinary wood screws to upright wood studs with a little mortar in the joints, and horizontal edges are rebated together. The concrete can be substituted for wood studs. The usual varieties supplied are, first, cottages "but and ben," two together of one storey, in French and Scotch style, the building being supplied and set up in any part of England for £100, by Mr. W. H. Lascelles, the well-known wooden house builder, of Bunhill-row. Second, temporary cottages of one to four rooms. Third, ornamental cottages of three storeys; and, fourth, plain two storey ones. No foundations are required. The proprietor says 1½ inches of concrete screwed to wood studs three feet apart must be cheaper than a brick wall and foundations. The slabs are prepared for export.

MUSICAL PUBLICATIONS.—Messrs. Swan and Pentland, Great Marlborough Street, have recently produced some fine specimens of musical publications—a printed and manufactured article. The notes, &c., are printed in quite a new style, and are superior to the productions of some even better-known publishers. Their "Jessamine Polka," which has a pretty picture of that flower, and affords excellent polka measure, is likely to assist in keeping up the prestige of that lively old dance; their "Great Gun Galop," with an amusing picture

of that monster *injens* (!), which also affords very good time—indeed brilliant; and a song, "The Lighthouse Keeper," are also good specimens. Messrs. Duff and Stewart announce a song, "Rappelle-toi," which, having seen, we can recommend as an improvement on "Then Remember Me." The song is truly beautiful,—of the Gounod School,—and the arrangement of the refrain is novel and very affecting. Favourable mention is due to some pieces with opera subjects, each one opera the first of a series,—e.g., "Favorita," arranged by Adrien de l'Orme. Mr. Goddard's Repertoire includes some excellent specimens of adaptations of Gounod. This publisher takes up that field as a speciality, and lovers of that popular maestro should inspect: one of his new pieces is suited for the scientific musician and student. Messrs. Weekes and Co. show six new works: two songs, "Where is my Bastik gone?"—words by A. S. Gatty, with picture of a cat by celebrated animal painter, Louise Corbeaux—and "The Child's Prayer," are good of their class, and the others are well represented by Sprays of Melody—first of a new series of pianoforte pieces—displaying pages of well-studied music.

RELIGION AND SCIENCE.

It has frequently been remarked that a religion is not worthy of the name that cannot bear the light of scientific enquiry and critical investigation; it is, therefore, surprising to find such a man as the Earl of Shaftesbury attempting to throw discredit upon Christianity by propagating the notion that it is founded on so weak a basis that it cannot bear discussion or the diffusion of truth without its very existence being jeopardised. Some lengthy correspondence has recently been going on between the noble Earl and the Rev. T. G. Bonney, of St. John's College, Cambridge, and who has recently been appointed to the Professorship of Geology in University College, London, as to the Earl's statement that Prof. Bonney's "Manual of Geology" was "of a most noxious character." In reply to a letter calling for an explanation of this language, Lord Shaftesbury says that at the moment the work is not within his reach, and he cannot refer to exact passages, but "it is of no importance. I take readily the whole responsibility of what I have written, and I abide by my words." As the Bishop of London returned no answer to his objections to the book, he had reason to conclude, and did conclude, that they were solid and true. Mr. Bonney rejoins, and states (*inter alia*) that he considers his lordship is bound to specify the precise grounds which gave rise to his language. He denies that the book teaches evolution. At great length the noble Earl replies, giving extracts on the antiquity of the human race, which he considers treat in a slashing way the first chapter of Genesis; and says that he and the weaker part of mankind are quite competent to judge of any crude statements asserted one day and denied the next. Of the progress of true science he has no fear. He knows that few sympathise with his views; of the clergy the mass agree with Mr. Bonney, and the laity are indifferent. Mr. Bonney rejoins in a long letter, especially canvassing Lord Shaftesbury's statement that the evidence of the flint instruments is meagre and feeble.

A Papyrus has just been added to the Manuscript Department of the British Museum, in the form of a fragment recording the transfer of some landed property at Ravenna. It is written in the particular Roman cursive character of the period to which it is attributed, the seventh century, and may be compared with other specimens in the Museum derived from the same locality.

A NEW METHOD OF RENDERING GLASS OPAQUE.

THE various methods now in use for rendering glass opaque are, first, painting or covering one of the faces with an opaque white substance, such as alabaster, barytes, &c., mixed with oil. Second, causing the surface to be attacked by hydrofluoric acid. Third, covering the surface with ground glass in powder, and submitting the whole to vitrification at temperatures low enough to cause adherence of the powder without producing deformation of the sheet. Fourth, grinding the surface with emery. Fifth, abrading it by the sand blast; and sixth, depositing thereon a salt in crystalline form.

A new process has recently been devised by M. Aubroit, by means of which he produces so-called muslin glass, of a great variety of colours. He proceeds as follows:—After carefully cleaning the surface a layer of vitrifiable colour is laid over it. The vehicle is simply gum water, and care is exercised that the pigment is evenly applied. The glass is then submitted to a mild heat until the water has evaporated, when a stencil of the desired pattern is laid over the surface, and a stiff brush is used to remove the loose pigment from the parts which are to be transparent. The glass is next enclosed in a frame, and above it is extended a piece of tulle, or, if desired, embroidered lace, the embroidery in the latter case being so disposed as to harmonise with the ground pattern previously made. The whole is then hermetically closed in a box, which contains in its lower portion a reservoir in which is a certain quantity of dry colour in the form of impalpable powder. This, by an air blast, is blown evenly upon the glass, and adheres to the latter wherever the surface is not protected by the threads of the lace. In this way the pattern of the latter is defined. In order to fix the powder, the sheets of glass are placed in a steam chamber, where the steam moistens the gum and causes the powder to adhere. The colour is then burned in a special furnace. By using different colours, it is said that very beautiful designs can be produced in this way, opaque or transparent, according as the pigments themselves are the one or the other. Remarkable effects also are obtained by the superposition of the tints.—*Furniture Gazette*.

RECENT AMERICAN AND FOREIGN PATENTS.

J. M. Bassett, of Athens, Ga., has invented a plough, so constructed that the standard can be easily adjusted to give any pitch desired. The branches of the standard in which the plough beam rests are secured to the beam by a clamp formed of a bow and a bolted yoke. By loosening the clamp the standard can be easily moved. It will prove a very acceptable instrument to farmers.

Samuel Myers, of Adamsborough, Sharpsville, Ind., has invented an improvement on his fruit drier which he patented in April 24, 1877. The supply of heat to the fruit trays is regulated at will, and each tray is independent of each other in the drying process. The improvement consists of the connection with the trays of diagonal partitions and pivoted valves, that open or close the space between the shelves and partitions, for admitting or excluding the heat from the rays.

In a universal joint patented by Phineas Burgess, of Brooklyn, New York, the flattened ends of the shaft have the inner lugs formed upon them, at such a distance from the outer or ordinary lugs as to rest against the inner side of the coupling ring, interposed between them and the outer lugs, and receive and support the inner ends of the coupling bolts.

James White, of North Adams, Mass., has

invented an improvement in spindles and their bearings. The spindle is provided below the upper shoulder with a second shoulder, between which and the collar of the upper bearing a small annular air chamber is formed, which surrounds the upper chamber. The oil is introduced through holes in the upper bearing, and any waste oil is caught by a cup-shaped support at the bottom.

Hermann Springborn and C. H. Bauch, of Holyoke, Mass., have invented an improvement on their cloth-finishing machines, patented July 17, 1877. It consists in constructing the concave bed with a detachable unoxidisable jacket, and in a locking device for the weight-adjusting levers. The bed with brass jacket is much cheaper than one made wholly of brass.

A blind-slat planer, patented by R. S. Griffin, of Worcester, Mass., consists in combining with a suitable bed and laterally adjustable guides, suitably mounted, a rectilinear reciprocating plane, the cutters of which are so arranged that they will dress one side and one edge of a slat. A novel device keeps the slat down firmly on the bed, and discharges the dressed slat from the machine.

In a rag-washing machine for paper making, patented by F. A. Cloudman, of Cumberland Mills, Me., a cylinder is arranged at the inside with a number of curved buckets extending from the circumference to a central outlet and flanged at the edges. The volume of water is lifted to a lesser height, by reason of the peculiar form of the buckets and their inclination toward the outlet. The buckets are best made of a continuous piece of wood, and are surrounded with wire cloth to retain the rags.

R. S. B. Thornton, of Pawtucket, has patented an improvement to be applied to the Noble Wool Combing machine. A shaft drives a flanged pulley keyed on it, which communicates motion by an endless belt to two other flanged pulleys. They are fitted on longitudinally slotted pieces and brackets secured by thumb screws.

An improved traction wheel has been patented by W. H. Trenwith, P. O. Box 4,068, New York city. It consists of a movable web or centre section, supported on rollers or wheels arranged within a revolving traction wheel of larger diameter, the web supporting an axle made of two symmetrical sections, to one section of which suitable operating mechanism is applied. It furnishes a simple means for starting the vehicle and stopping the same without the use of brakes.

Stephen Townsend and John Vickers, of Guysville, Ohio, have patented a gate hinge, which is adapted for farm gates which open by first sliding back half their length and then swinging around into a position parallel with the roadway. The pivot and socket portions of the hinge are constructed in such a manner that the former may be detached from the latter when adjusted in a certain position, this position being, however, one which the parts cannot assume so long as the hinge is in use for supporting the gate.

An apparatus for applying poison to plants, invented by James L. Goodin, of Montgomery, Texas, consists of a tank to receive the poisoned water, and which has a discharge pipe, the inner end of which is provided with a valve. The stem of the valve passes up through a hole in the tank and is pivoted to a lever, which is itself pivoted to a short standard. Three nozzles connected with the discharge pipe distribute the water.

Thomas H. Parvin, of Chicago, Ill., has patented a lever take-up for grain binders. The invention consists in a lever carrying a sheave, which acts upon the wire or cord, the said lever being connected with another lever that is moved by a cam on the main or other shaft of the binding apparatus. A

varied or uniform tension of the wire may thus be secured.

In a rotary churn, patented by John W. Hazellrigg, of El Dara, Ill., the upper end of the churn shaft, above the top board, is surrounded by a ring groove, to receive the forked end of a lever, which is slightly bent, and is pivoted at its bend to the top board. By pressing down the rear end, the shaft will be raised and disconnected from the dasher shaft, allowing the hub and the upper end of the dasher shaft to be disconnected and the churn and dashers to be removed.

A plough, patented by William W. Dawson, of Madisonville, Texas, has the point made with a landside, fitting into a rabbet in the landside of the standard, and made thicker and deeper than the rabbet, so as to project beyond and below the landside to receive the wear. It may be kept in repair at small expense.

A whip socket patented by George E. Hendey, of Waterbury, Conn., is attached to the dasher by lugs, which are secured by tapering screws having screw threads upon their smaller ends. The screws secure the socket securely in place and act as wedge keys.

THE LIFEBOAT WORK IN 1877.

DURING the year which has just closed, the Lifeboats of the National Lifeboat Institution rendered the following services on different parts of the coasts of the United Kingdom. The unusually severe storms of the past two months tested to the utmost the qualities of the Institution's large life-saving fleet; but on every occasion both the brave men and their boats were found fully equal to every emergency. Barque Result, of Guernsey, 9 lives saved; smack John and Eliza, 2; smack Sarah, 3; barque Ida, of Glasgow, 1; s.s. Nuphar, of Shields, rendered assistance; barque Sisters, of Sunderland, 11; ketch Les Deux Sœurs, assisted to save vessel and 13; s.s. Ludworth, of London, assisted to save vessel and 16; a boat of Porthdinlaen, saved boat and 2; s.s. Urania, of Swansea, 10; barque Nanta, of Lussino, 13; brig Aurora, of Ardrossan, 7; fishing lugger Mountain Hare, of Wexford, 6; smack Ann Pritchard, of Carnarvon, saved vessel and 2; brig Dillwyn, of Swansea, saved vessel and 8; sloop Darling of Beaumaris, assisted to save vessel and 2; brig La Belle, of Shoreham, 8; schooner Rebecca and Mary, of Carnarvon, 5; schooner Lizzie Male, of Padstow, 6; barque Constantia, of Sunderland, 12; schooner Annie, of Padstow, 5; barque Dorothea, of Sunderland, assisted to save vessel and 11; barque James Vinnicombe, of Sunderland, assisted to save vessel and 17; barque Queen of Hearts, of Miramichie, N.B., 1; ship Marietta, of Liverpool, 13; Italian barque Iside, rendered assistance; schooner Sarah Ellen, of Liverpool, 3; schooner Jeune Prosper, 1; schooner Plymouth, of Plymouth, 4; schooner Helene, of Rye, 3; ship Flora, of Liverpool, rendered assistance; dandy Adventure, of Bridgwater, 4; brigantine B. F. Nash, of New York, 11; smack George Evans, of Newquay, 2; schooner Supply, of Newport, 3; barque Ada Melmore, of Maryport, 10; fishing coble Ann and Elizabeth, and another coble, 7; brig Christopher Hansteen, of Christiania, 8; ketch Aid, of Hull, assisted to save vessel and 4; schooner Mary, of Liverpool, 3; schooner Sea Lark, of Castlehill, assisted to save vessel and 5; s.s. James, of Greenock, 4; schooner Harriet, of Goole, rendered assistance; schooner Johanna Vrow, of Altona, assisted to save vessel; schooner Jessie, of Perth, 4; schooner Fria, of Thisted, assisted to save vessel and 7; barque Eva, of Dublin, 3; brig Crocodile, of Dartmouth, remained by vessel; twenty-one fishing-boats of Eyemouth, assisted to save boats and 21; Newbiggin fishing-cobles, rendered assistance; barque Victoria, of Sunderland, 9; schooner Mary Helen, of Fowey, saved vessel; schooner

Charm, of Montrose, 3; schooner George Brown, of Montrose, 2; brigantine Ocean Packet, No. 3, of Harlingen, 7; brig Fortuna, of Oster Risöer, 6; Cardigan Island, 4; smack Elizabeth, of Cardigan, 2; Henri Helene, of Nantes, rendered assistance; schooner Jane, of Whitehaven, 5; schooner Andromeda, of London, 6; smack Prospect, of Eyemouth, 2; brig Berdinkha, of Hartlepool, 14; s.s. King Ja-Ja, of Carnarvon, 10; galliot Vier Bröders, of Rotterdam, 4; brig Suez, of Sarpsborg, 9; smack White Rose, saved vessel and 6; schooner Isabella, of Portmadoc, 5; steamer Dakota, of Liverpool, 20; barque Wohldorf, of Kiel, assisted to save vessel and 9; smack Newland, of Kilkeel, saved vessel and 3; brigantine Pembrokehire Lass, of Milford, 5; barque Junak, of Spalato, 14; schooner Aurora, of Christiania, 6; a fishing-boat of Sheringham, saved boat and 2; lugger Harkaway, of Shoreham, saved vessel; a fishing-boat in distress off Worthing, remained by vessel; schooner Hannah and Joseph, of Liverpool, assisted to save vessel; schooner Wave, of Guernsey, 6; brigantine Elizabeth Brooks, of Larne, remained by vessel; boat Jane, of Hunstanton, 6; barque Asow, of Christiansund, saved a boat and 8; Fraserburgh fishing-boats, rendered assistance; yacht Linda, of Carnore, 2; schooner Fuschia, of Goole, 8; fishing-boat Vigilant, of St. Andrews, 1; smack Ebenezer, of Bideford, 3; brigantine Blanche et Louis, of Nantes, 4; schooner Maggie Kelso, of Ardrossan, 3; ketch Pallas, of Jersey, assisted to save vessel and 5; cutter-yacht Nelly, of London, rendered assistance; barque Alma, of Drammen, rendered assistance; brig Hope, of Hartlepool, assisted to save vessel and 8; three Teignmouth fishing-boats, 10; ship Sarah, of Yarmouth, N.S., 18; brig Anna Maria, of Blyth, assisted to save vessel and 7; schooner Wancoma, of Belfast, 2; fishing-boat Pet, of Lowestoft, 11; barque Augia, of Guernsey, assisted to save vessel and 10; brig Lily, of Guernsey, assisted to save vessel and 8; schooner George and Valentine, of Dunkirk, 5; barque Noah I., of Rotterdam, assisted to save vessel and 20; Swedish barque Hedvig Sophia, 12; French brig D'Artagnan, 5; brig Craigs, of Whitby, assisted to save vessel and 1; schooner Vine, 2; schooner Barrogill Castle, 10; schooner Guiding Star, of Wick, 8; schooner Kate, of Ramsey, 4; schooner Alfred and Emma, of Barrow, 4; brigantine John Douse, of Falmouth, 2; schooner Ensaimainen, of Borge, Finland, 12; brigantine Test, of Portmadoc, rendered assistance; brigantine Louisa, of Weymouth, saved vessel and 7; brig Eidsvold, of Arundel, assisted to save vessel and 8; cutter Martin Bailly, of Yarmouth, assisted to save vessel and 6; schooner Barkley, of Ipswich, 5; barque Hannah Rathkens, of Rostock, 5; schooner Jane and Ellen, of Nefyn, 3; brigantine Mystic Tie, of Ardrossan, 7; schooner Agnes and Helen, of Bangor, 4; brig Beatrix, of Whitby, 6; schooner Allerton Packet, of Whitstable, 5; barque Alpha, of Shoreham, 12; a French brig, rendered assistance; three-masted schooner James Carthy, 10; schooner Jane Cameron, 5; schooner Gleaner, of Southampton, assisted to save vessel and 4; brigantine Mermaid, assisted to save vessel; fishing-vessel Success, of Ramsgate, rendered assistance; schooner Starling, of Goole, assisted to save vessel and 5; brig Happy Return, of Guernsey, assisted to save vessel and 8; brig Reward, of Guernsey, assisted to save vessel and 8; smack Arrow, of Guernsey, remained by vessel; brig Lady Havelock, 8; ship Crusader, of Liverpool, 22; barque Jacob Langstrum, of Gothenburg, 8; steamer Rainton, of Glasgow, rendered assistance; s.s. Bohemian, of Liverpool, remained by vessel; ship Ceres, of Greenock, 23; three-masted schooner Fred Eugene, of Portland, Maine, 9; and barque Hero, of North Shields, 15. This long list makes a total of 841 lives rescued by the Society's Lifeboats during the past year, besides 35 vessels saved from destruction. In the same period the Lifeboat Institution

granted rewards for saving 200 lives by fishing and other boats, making a grand total of 1041 lives saved last year, mainly through its instrumentality. Altogether, since its formation, the Society has contributed to the saving of 25,400 shipwrecked persons, for which services it has granted 978 Gold and Silver Medals, besides pecuniary rewards to the amount of £54,000. The storms of last November will long be remembered for their frequency, their violence, and the noble services of the Institution's Lifeboats, which saved nearly 300 lives in that month alone. After performing these services some of the Lifeboats' crews returned home absolutely exhausted; in some cases many of the men's lives were actually despaired of for several days afterwards. It should be mentioned that the operations of the National Lifeboat Institution now cover the whole coasts of the British Isles, and that, with the exception of a score or so of Lifeboats which belong to harbour trustees and other local bodies, the whole of the Lifeboats of the United Kingdom belong to the National Institution. Thus we feel assured that an Institution so truly national and benevolent in its character will maintain its firm hold on British sympathy and support; and that while it continues to pursue its course of usefulness with unabated vigour, the support and appreciation of the public will be proportionately liberal. We will only add that contributions in aid of the great and important work of the National Lifeboat Institution are received by all the Bankers throughout the United Kingdom, and by the Secretary, at the Institution, 14, John Street, Adelphi, London.

CARBON IN CHEMISTRY.

The elements carbon, hydrogen, oxygen, and nitrogen have been called *organogens*—that is, organ producers—from the important part they play in the organic world. They make up the great bulk of the vegetable and animal creation, the other elements that enter into the composition of organic substances forming comparatively an insignificant part of their structure. But among these four organogens carbon holds a peculiar and prominent place, as the one element that seems indispensable to the existence of an organic compound. It is pre-eminently the organic element, not merely because it is always present in animal and vegetable substances, but because they appear to owe their existence to its remarkable properties. These compounds, although they contain but a few elements, are numberless and of almost infinite diversity of constitution and properties; and this is due, not to the so-called "vital force," but to the singular capacity of the carbon atoms to bind together a great number of other atoms into a complex molecule. This makes a great variety of molecular structure possible with a limited number of elementary atoms. The materials are few and simple; the forms into which they are arranged by the cunning hand of the master-builder, Carbon, are of inconceivable diversity. In fact, as Professor Cooke has said in his "Chemical Philosophy," organic chemistry "is simply the chemistry of the compounds of carbon, and has no distinctive character except that which the peculiar qualities of this singular element give."

In the department of inorganic chemistry we often find two elements uniting in several different proportions to form compounds whose properties are very dissimilar; but here the limit of possible changes is soon reached. An atom of one element combines with one, two, or three, or at most five or seven, of another, and there is an end of it: while the carbon compounds run on in long series, adding atoms to atoms, until the numbers that represent their chemical constitution are high among the tens and even into the hundreds. The formulæ of many of these series are tabulated in manuals of chemistry. The law of their formation is as clear as that of an arith-

metical progression. In some of them most of the compounds forming the regular succession of terms are already known, while in others many remain to be discovered by chemists. There is a series of organic acids, for example, of which formic acid, or CH_2O_2 , is the first, and the successive members of which add an atom of carbon and two atoms of hydrogen to the formula of the next preceding in the list: as $\text{C}_2\text{H}_4\text{O}_2$ (acetic acid), $\text{C}_3\text{H}_6\text{O}_2$ (propionic acid), $\text{C}_4\text{H}_8\text{O}_2$ (butyric acid), $\text{C}_5\text{H}_{10}\text{O}_2$ (valerianic acid), and so on, until we get up to $\text{C}_{30}\text{H}_{60}\text{O}_2$ (melissic acid), and we know not how many beyond.

Among familiar compounds we may find some of the most unlike thus built up of atoms of the same elements, but differing slightly in their atomic proportions. For instance, sugar, starch, alcohol, and vinegar are as different in their properties as four substances well could be; yet all four are composed of carbon, hydrogen, and oxygen in slightly varying proportions. The formula for sugar (our common cane-sugar) is $\text{C}_{12}\text{H}_{22}\text{O}_{11}$; that of starch is $\text{C}_6\text{H}_{10}\text{O}_5$; that of ordinary alcohol is $\text{C}_2\text{H}_6\text{O}$; and that of acetic acid (which when diluted with water constitutes vinegar) $\text{C}_2\text{H}_4\text{O}_2$. We need not wonder, then, at such chemical magic as the transmutation of starch into sugar, of sugar into alcohol, and of alcohol into vinegar. These are only examples of the sleight of hand at which this prestidigitateur among the elements is an expert. It is but dropping an atom or two of oxygen, and picking up an atom or two of hydrogen, or some such dexterous manipulation, and, presto! the compound undergoes a sudden and mysterious metamorphosis. A little water, or the hydrogen and oxygen thereof, is added to the starch, and we have sugar—that is, grape-sugar—and dextrin, the gum used on the back of postage-stamps. Dissolve the sugar, cause it to undergo fermentation, and straightway alcohol and carbonic acid are the results. Dilute the alcohol, let it ferment again, and acetic acid and water make their appearance.

RAG SUGAR.

One of our subscribers in a distant part of the country has just written to us, stating that he has heard of "old rags being changed into sugar," and wanting "to know if it can be done." He is evidently incredulous as to the possibility of such an operation, but we can assure him that there is no doubt of it. The process is not at all a new one, having been described in an article which appeared in the *Journal* some ten years ago. This transformation, which appears so miraculous to one unfamiliar with chemical reaction, is akin to those we have just mentioned. Linen and cotton rags are simply forms of woody fibre, which has the same chemical constitution as starch, and like starch may be easily converted into glucose or grape-sugar. Paper, sawdust, or any form of woody fibre will answer the purpose equally well. Of course woollen rags will not do, though the first edition of a certain popular text-book of chemistry contained the rather startling statement that sugar had been made out of an old flannel shirt.

But the most wonderful metamorphosis of these carbon compounds takes place in the cells and tissues of plants and animals. In these microscopic laboratories what marvels of chemical manufacture are being effected! What myriads of curious and complicated products are here concocted! Every vegetable and animal substance that serves our use or our pleasure is thus prepared for us. It is interesting to visit a manufactory where the brilliant aniline dyes now so extensively used for colouring textile fabrics are made from the filthy coal tar, which is a waste product of the gas works; but a far more wonderful transmutation is continually going on in the rose in your garden or the violet by the wayside. The flower derives the materials of its beauty and fragrance from the air and the earth, and elaborates these into the exquisite products that so delight our senses. The

delicious juices of the grape and the peach are distilled in the alembic of the vine or the tree by a like subtle alchemy. The rich spices of "Araby the blest" have the same origin; hence, too, come the healing balms and balsams, the potent alkaloids of the medical art, and whatever else we draw from the vegetable kingdom to supply our needs or gratify our tastes.

All the processes of animal life are likewise illustrations of this chemistry of the carbon compounds. Our bodies are built up of these compounds, fabricated in the minute cells of the system from materials already prepared by the plant, which is the pioneer of the animal in the great march of organic life. Even the subtle processes of thought are dependent on the transformation of carbon compounds. The fires of feeling are fed with fuel which does not really differ from that burnt on the household hearth.

It may be added, in conclusion, that the allotropic forms in which carbon exists as an element are suggestive of the protean aspects under which it appears in its compounds. Carbon is found in nature as the diamond, as graphite or plumbago, and as coal. The diamond is the purest and most transparent of crystals, the hardest of known substances, unaffected by the atmosphere and all ordinary chemical agents, the type of permanence and indestructibility. Graphite we might at first take to be a metal, from its texture and lustre; it differs from the diamond in all respects except that it is practically indestructible. It is at once very soft and very hard and refractory. We make from it our lead pencils, which are worn away by the slightest friction on paper; and we shape it into crucibles which endure the fiercest heats of our furnaces. Coal, whether charcoal or cannel or anthracite, resembles neither the diamond nor graphite. It is indeed black like the latter, but without its peculiar metallic lustre; and whereas neither graphite nor the diamond can be ignited in any ordinary way, the most marked characteristic of coal is its ready combustibility. Its obvious end and purpose is to be burned, and it keeps up the fires, domestic and industrial, of almost the entire world. There are other elements—like sulphur and phosphorus, for example—which are remarkable for the allotropic forms they assume, but carbon must be regarded as surpassing them all in this respect, and the peculiarity seems typical of the imperial place it was destined to hold in the realm of organic nature.—*Boston Journal of Chemistry.*

SCALES FOR DRAWINGS.—Mr. Edwin Lawrence recently wrote to the *Times*:—"It may be valuable to those of your readers who intend to exhibit plans or models at the Paris Exhibition to know that these can be made to a scale capable of being expressed in any language. The only common measure between English feet and inches and foreign decimal scales are the numbers 2 and 10, so the only possible international scales are the following:—Full size=grandeur naturelle; half full size, or 6 in.=1 ft.=le moitié ou '5; quarter full size, or 3 in.=1 ft.=le quart ou '25; $\frac{1}{8}$ in.=1 ft.=.125; $\frac{3}{8}$ in.=1 ft.=.0625. Or 1-10th of any of the above—viz.:—12-10 in.=1 ft.=.1; 6-10 in.=1 ft.=.05; 3-10 in.=1 ft.=.025; 3-20 in.=1 ft.=.0125; 3-40 in.=1 ft.=.00625. A drawing has only to be made of any of these scales, and marked with the English words, and the corresponding decimal will be understood all over the world."

A GEOGRAPHICAL SOCIETY has been founded at Quebec, of which Dr. Fortin was elected President. As far as we know, this is the only Society of the kind existing in our Colonies. It will more especially direct its attention to a thorough exploration of the "Dominion," with a view of husbanding and utilising its natural resources.—*Athenæum.*

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